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THE PROPOSED HARLEM RIVER BRIDGE.

Last year, in accordance with an act of the New York Legislature, three commissioners were appointed by the Mayor, Comptroller, and President of the Board of Aldermen of New York city, for the purpose of constructing a bridge across the Harlem River at 181st Street. On October 15, 1885, the commissioners advertised for competitive designs for the proposed bridge, and offered the following premiums for the three best designs they might select: $1,500 for the first, $1,000 for the second, and $500 for the third best design.

The designs were to be accompanied with specifications and approximate estimate of cost, and were to be presented before the first day of December, 1885.

The designs submitted for competition were to be made in accordance with the profile and memorandum furnished by the engineer of the commission, Mr. Wm. J. McAlpine. This provided for a clear river space of 400 feet between bulkhead lines, and specified that the grade of the roadway should be at least 145 feet above mean high tide, and the clear width of the bridge at least 80 feet, viz., 50 feet of roadway and two sidewalks, each 15 feet clear. It further specified that the superstructure shall be of steel or iron; piers, abutments, etc., of stone, to be founded on solid rock wherever practicable; that the structures must be designed to sustain their own weight and that of the roadway and footwalks of an estimated weight of 200 pounds per square foot; also a wind pressure of 400 pounds per lineal foot of bridge, and a live load of 100 pounds per square foot of roadway and footwalks; besides a floor strength to carry a twenty ton road roller of the usual pattern. The memorandum required a concrete floor on corrugated iron, with granite pavement laid in asphalt for the roadway and a pavement of bluestone and marble tiles for the footwalks.

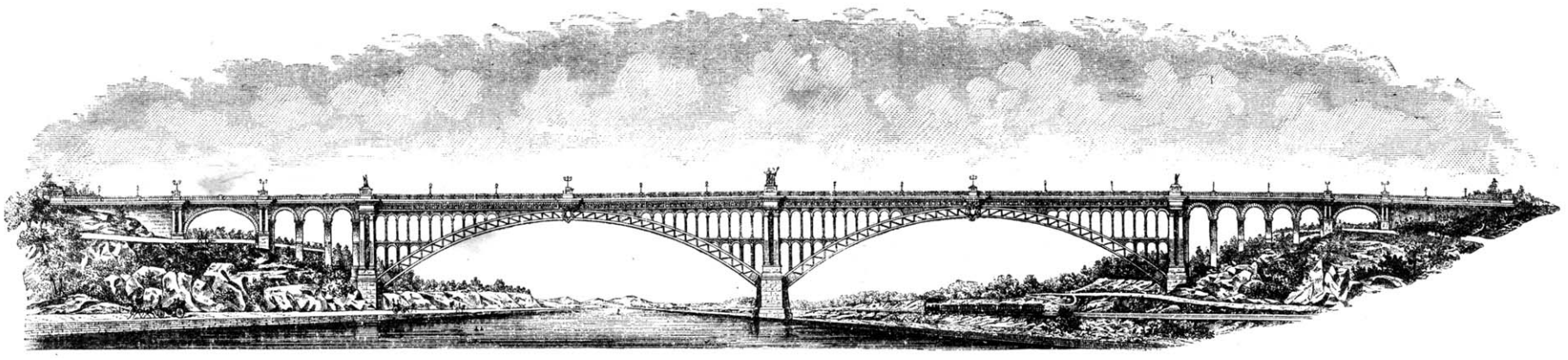
The commissioners received about twenty designs for the proposed bridge, from engineers of all parts of the country. From among these designs that submitted by Mr. C. C. Schneider, of New York city, was selected as the best, and awarded the first prize, and that submitted by Mr. Wilhelm Hildenbrand received the second prize. Both of these designs are illustrated upon this page.

Mr. Schneider's design consists of two metallic arches, each 410 feet clear span, and masonry piers and approaches. One of the metallic arches spans the entire width of the river, and the other the whole distance from the easterly bank of the river to Sedgwick Avenue.

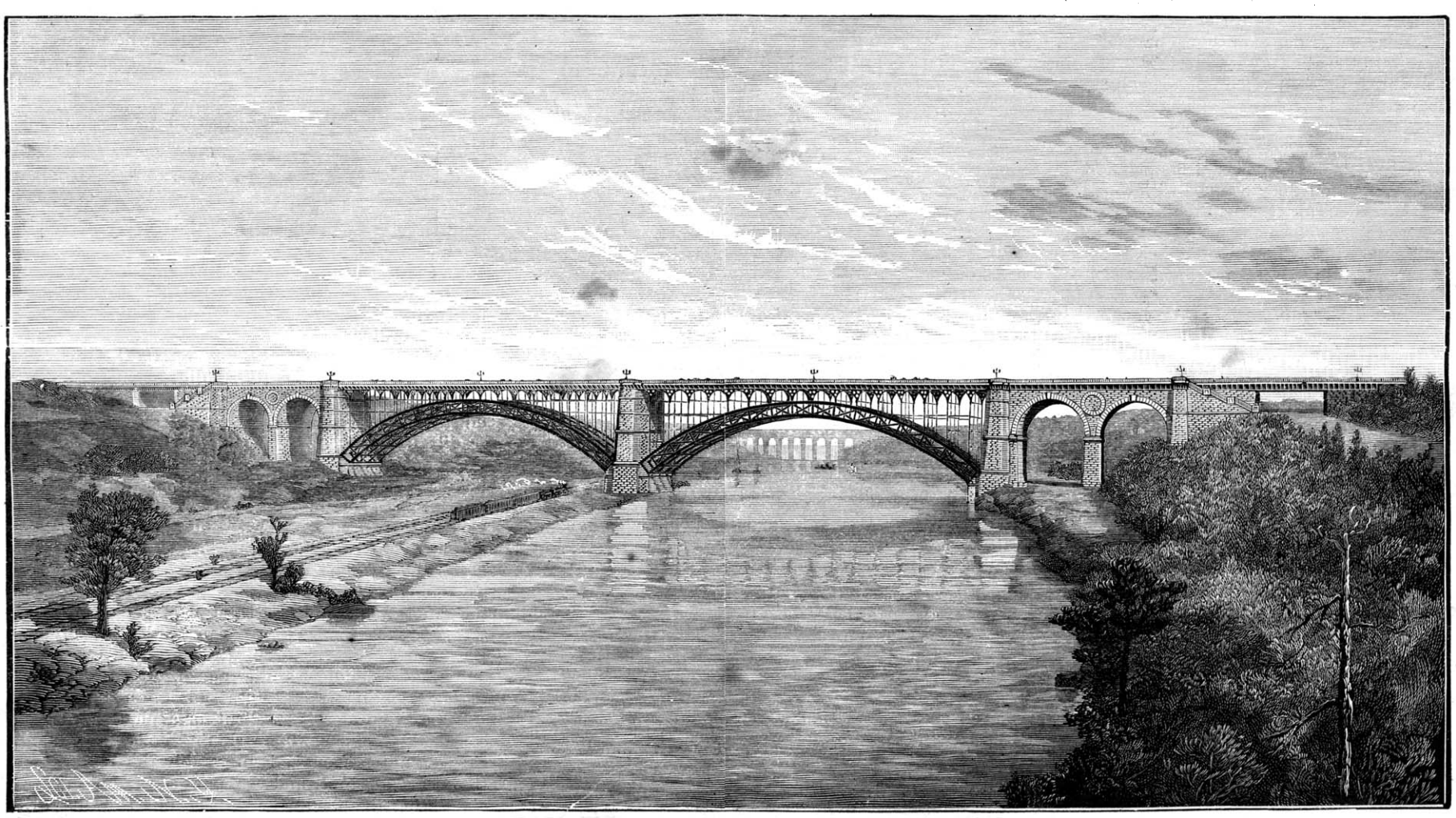
The masonry approaches are as nearly symmetrical at both ends as practicable, to accommodate the street crossings and the conditions of the profile. They consist of masonry arches, of 80 feet clear span, plate-girders across the Boulevard and Boscobel Avenue, and earth embankments, kept in place by retaining walls. The grade of the roadway is 150 feet above mean high tide.

The floor of the bridge is 80 feet wide, consisting of a roadway of 50 feet and two footwalks of 15 feet each. There is an ornamental iron railing on the outside of each footwalk over the metallic structure, and a cut stone balustrade over the masonry structure. There are stone steps on each side, leading from the Boulevard and Boscobel Avenue to the footwalks of the bridge.

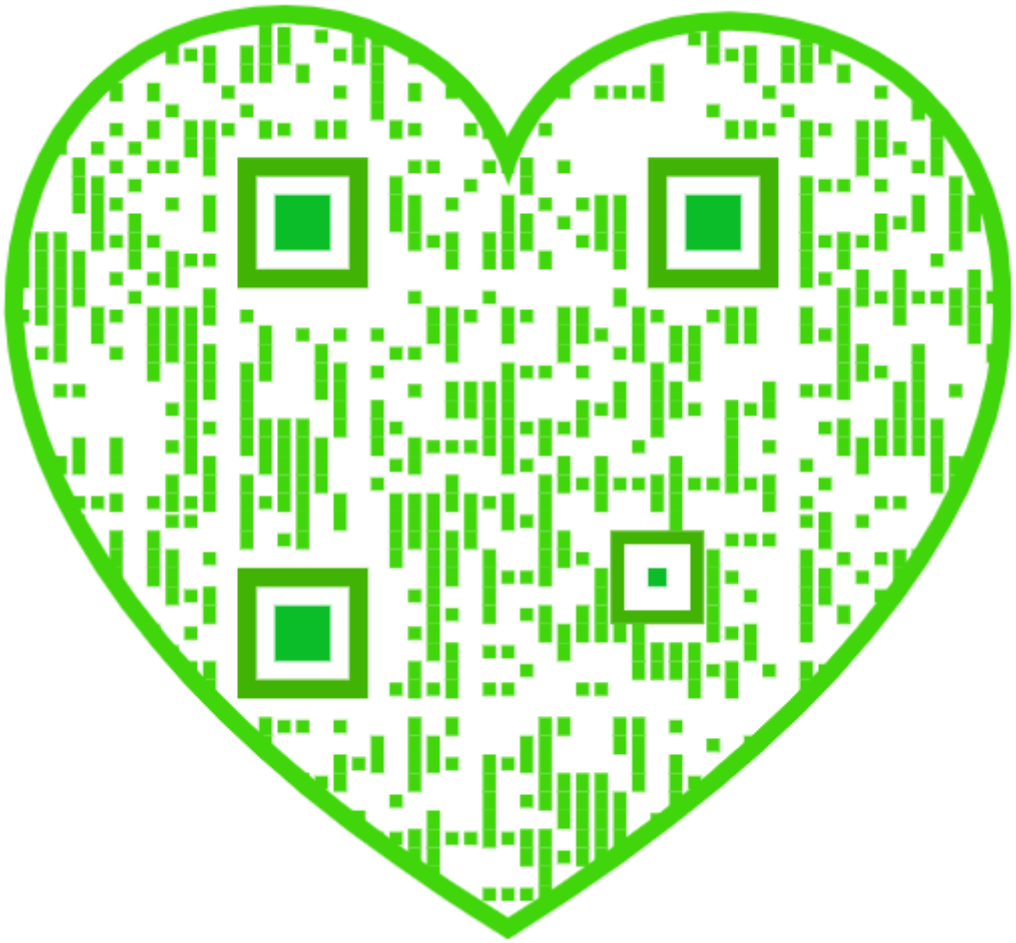
Each of the large spans consists of six separate braced steel arches, spaced 14 feet between centers, connected transversely and laterally by a system of lateral and sway bracing. The arches are hinged at the springing in order to allow a correct analysis of the strains in all the members. The floor system is carried on vertical columns, supported by the arches. It is composed of longitudinal iron girders, resting upon and secured to the tops of the columns, and on them the transverse floor beams are placed, consisting of iron plate girders, which carry the roadway and footwalks. The transverse floor beams project 6 feet beyond the structure below,



DESIGN FOR HARLEM RIVER BRIDGE LOOKING NORTH.—SECOND PRIZE.



DESIGN FOR BRIDGE ACROSS THE HARLEM RIVER AT 181ST STREET, NEW YORK CITY LOOKING SOUTH.—FIRST PRIZE.



thus forming a deep cornice with ornamental brackets underneath. The metallic structure is of the American pin-connection type, all parts being designed for mild steel or wrought iron. Cast iron is used only for cornices and ornaments.

The chords of the arches are made of steel plates and angles; they are 2 feet deep, latticed top and bottom. The web system of the arches consists of radial iron struts, made of 12 inch channels latticed and diagonal tension bars. All pins are of steel. The end pins which form the hinges are 20 inches diameter, and are supported on a steel pedestal. These pedestals rest on steel bed plates on the masonry skew-backs, and are adjustable by means of keys. The bed plates and pedestals are anchored to the masonry by heavy steel bolts. The vertical posts which carry the floor system consist of 12 inch iron channels, latticed; they are hinged to the pins of the upper chords of the arches, and stiffened by longitudinal struts and braced transversely by struts and sway rods. Laterally, the arches are connected by a strut at each panel point, attached to the main pins and braced transversely and laterally by iron rods. The lateral struts are composed of two 7 inch channels, latticed.

The roadway consists of corrugated iron plates ½ inch thick, resting upon the floor girders, covered with concrete shaped to the transverse form of the roadway. On top of the concrete there is a layer of Trinidad asphalt, and above that blocks of granite, 7 inches thick, set in asphalt.

The footwalks are paved with diagonal tiles of bluestone with a row on each side of tiles of white marble, with a cut granite curb.

The footwalk pavement rests on a layer of concrete or corrugated iron plates, the same as the roadway.

The foundations for the piers are intended to be carried to the solid rock.

The masonry will be faced with granite, laid in courses of 20 to 30 inches thick. The interior stone is to be of good quality of durable limestone, or such other stone as may be approved by the engineer of the commission.

All masonry will be first-class rock-faced work, with beds and joints dressed to a quarter inch. Copings, cornices, and parapets will be of cut stone.

The structure is designed strictly in accordance with the requirements of the specifications, and the construction details are all so arranged as to be accessible for cleaning and painting. This is a very important consideration in metallic structures, as the endurance of the iron and steel in works of this kind depends upon how they are protected from corrosion.

The structure, as designed by C. C. Schneider, is well proportioned in all its parts and details, and conveys the impression of strength and durability; it is symmetrical in appearance, and in harmony with the picturesque surroundings. The estimated cost of the whole structure is $2,075,000.

In Mr. Hildenbrand's design, shown in the upper view, which we take from *Engineering News*, the two center spans are each 540 feet, and the clear height of the arches above high water is 135 feet. The arches are to be constructed with three hinges. There are five arches in the entire width of the bridge, which is 80 feet. The center depth of the arches is 16 feet, increasing toward the abutments to 18½ feet. The main floor beams are supported upon latticed columns placed on these arches, 16 feet apart. The floor beams are 42 inches deep, and carry a series of longitudinal girders 20 inches high and spaced 10 feet apart. On the girders are placed 9 inch I beams 2½ feet apart, which support a corrugated iron floor covered with concrete and Belgian pavement for the roadway and marble tiles for the sidewalks. The chords of the arches are box-shape and composed of channels and plates.

The main bridge approaches consist of a number of stone arches, each 32 feet span, with two large stone arches over the Boulevard and Boscobel Avenue. The approaches are carried on earth filling, confined by retaining walls from the avenues to the termini. The total length of the bridge is 2,105 feet, the main arches with their abutments occupying 1,180 feet, the avenue arches 160 feet, the fillings 390, and the stone viaduct 395. The estimated cost of this structure is $2,250,000.

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NEW YORK, SATURDAY, MARCH 6, 1886.

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A REMARKABLE SNOW PLOW.

Much interest has been excited in railway circles at the West during the past few weeks by the performances of the new Leslie rotary steam snow shovel, on the Chicago and Northwestern Railroad Co.'s lines. The head of this machine is provided with angular cutting blades, which rotate with enormous velocity and cut and loosen the snow, which then passes behind the blades, where it is received on the flat spokes of another wheel, turning in a contrary direction, and is thereby thrown out sidewise from the machine with tremendous power. The snow is delivered in the form of a great stream, forming an arch through the air, and strikes the ground at a distance of from one to two hundred feet from the track. The machine, when in operation, is said to be a wonderful sight to behold. It is mounted on a special car, which also carries an engine for driving the mechanism. During the late heavy snow storms, when tracks were blockaded with from 3 to 10 feet of snow, packed so hard that the ordinary slow plows would make no impression on it, and could not have been cleared except by hand shoveling, involving several days' delay, this machine went through some of the worst drifts at the rate of a mile an hour, and through the lesser drifts at much faster speed.

PAINT, FINISH, AND POLISH.

The improvement in fit and accurate workmanship on machine tools and other productions of the machine shop is being fitly supplemented by finer finish and other exterior decoration, so that, properly enough, taste and utility, beauty and durability, are combined.

For many years, one fashion has prevailed in the painting of cast iron and of the unfinished portions of wrought iron; all being of one uniform lead color, or the color of blue slate. No difference was made on account of the weight or the contour of the pieces, and there was absolutely no relief from the depressing dullness of the leaden paint.

But on recent visits to shops where the best work is done, it was an agreeable surprise to see glossy black on the castings, complementing the sheen of the polished work. On some of the lighter machines the black itself was relieved by fine hair stripes of chrome green and Scheele's green, not brilliant and bold enough for contrast, but just enough to relieve the plain black and to define corners and curves.

An excellent effect is produced by rubbing faced castings with old files, washing with lye or soda, drying, and going over the surface with a swab dipped in dilute sulphuric acid, only strong enough to make a coat of rust, which will form in two or three hours. Then wipe with clean waste. The result is fine, the surface being of a warm russet tinge, closely mottled by the varying effects of the acid on the filed or brightened parts and the untouched skin of the casting. Treating the bed of a lathe or planer in this way, and painting the legs black, make a very satisfactory combination with the polished work. As a general rule, only the moving parts of machinery should be bright finished.

Finishing or polishing are matters of taste and choice; some mechanics are rigid in admiring nothing but a finish; a polish to them is a finical whimsey. But these effects may be judiciously combined in the same machine. Thus, a draw file finish may offset shining rouge polish, the draw file for straight surfaces or planes and the polish for curves and mouldings. Draw file finish is very satisfactory to the eye of the practical mechanic, as it denotes skill of hand and exact work; if it is the least bit wavy, or slanted, or crossed, the effect is spoiled; the marks of the file must be parallel. Some prefer a dead smooth cross cut finish file for this work, but the result is excellent with a fine cut float file, half worn, and used with plenty of oil, enough to "float." For this purpose, ordinary kerosene oil is better than the thicker lubricating oils.

Stoning for ornamentation is common, but it is not generally used judiciously; there is usually too much stoning. The work is very inviting, as it will readily half conceal the lack of file or scraper finish. For stoning, only small slips should be used or the points of larger ones; broad smutches of stone rubbing are coarse and crude. Let the work to be stoned be well surfaced with file, scraper, or, where permissible, with emery, before the stone is used—and better work can be done with water than with oil. The stone makes a nice ornament rubbed in straight lines and angles—better than curves. The writer saw a pattern known as Grecian border put around the sides of a lathe apron with stone on an emery and rouge ground of shining polish. It was rich, consisting solely of straight lines and right angles.

Stone in powder is excellent for a plane surface of considerable extent where shining polish is not desired. The stone used is preferably the yellow, not the white, oil stone, and the powder is of a fineness almost impalpable to the fingers, but showing grit when placed on the tongue and lips. This is applied with water and a stick of soft white pine, or white-

wood, or cucumber tree, or poplar—any wood that is soft on end, or brooms slightly, and contains no pitch or gum. A fine dead surface can be got thus with powdered oil stone, and the stick may be whittled to work in curves and channels.

Scraping for ornament is quite common, but as usually practiced it is as objectionable as stoning—there is too much of it. The flat scraper should never be used for ornament—only the round nose and the "bagnet" scrapers. And for this purpose the scraper should never be used in right lines, only in curves, making "curly-cues." The surface to be scraped for ornament should be filed or emery rubbed to take out all turning marks and planed ridges; no suggestion of the lathe or the planer tool should be left. Stoning looks well on either a dead smooth surface or one of high polish. Scraping over a planed surface, left as it came from the planer, only serves to show, with more distinctness, the furrows and ridges inseparable from planing, even with a finish tool. And the scraping should be done with a very light hand, so that its effect on the surface could not be detected by the finger ends.

Some very unique work, partaking of the scraping process, was noticed lately in a shop where fine machine tools are made. The scraper was formed with very fine teeth. It was forged from a three-eighths square bar of fine steel of the proper length for use, the end flattened slightly and turned at right angles, the angular portion projecting perhaps one-eighth of an inch. This portion was ground, milled, or filed to an edge, and then was chased on a "hob," or master tap of fine thread, from a pitch of 60 to one of 100 to the inch. The tool was then hardened and drawn to a straw color. The size here designated may be varied at will; indeed, to do the best work several sizes are necessary. Following graceful curves, these tools will produce a series of fine parallel lines suggesting the engine turning on the backs of watches. The surface for this work should be finely finished and polished.

Some acids judiciously applied produce fine effects. Etching in patterns ought to be confined to finished steel, wrought iron, copper, brass, and bronze; when used on cast iron for pattern work, the acid will not leave clean lines. Ordinary etching in pattern is done by cleaning the surface with lye, then covering it with engravers' etching ground, made of Venice turpentine, Burgundy pitch, and spirits of turpentine. It may be obtained ready prepared at supply stores for engravers and for calico printers. Or a coat of common beeswax melted and rubbed on with a cloth or applied on the heated work, if heating is feasible. The pattern is made through the resistant etching ground by means of suitably shaped steel points, hard enough to scratch the metal. Then equal parts of sulphuric and nitric acids, with twice their combined volume of water, or more, if the metal is soft like copper, are mixed and applied to the work. The pattern will be etched after an hour's exposure, the resistant defending the finished portions.

Lemon juice is very effective on a surface of cast iron, and its result is quite elegant. It turns the portion of polished cast iron to which it is applied to a bronze black, and when touched over with shellac will absorb a sufficient amount of the varnish to preserve it. To many, lemon juice would seem to be a weak and ineffective acid for metal; but every one knows how quickly a knife blade of steel will blacken when used to cut a lemon. The writer has a lemon squeezer made of cast iron, zincked, which with use has a hole eaten through it half an inch diameter, by the action of the acid. The darkening of polished iron by this citric acid is very beautiful.

THE first shipment of Alabama coal to a foreign port was made from Mobile to Cuba last week by schooner.

The Patent Office Business of 1885.

According to the recently submitted report of the Commissioner, covering the business of the Patent Office for the last calendar year, it appears that there were 24,233 patents and reissues granted in 1885, as against 20,413 in 1884, and 22,383 in 1883. The States represented by more than 1,000 patents each were New York, 4,532; Pennsylvania, 2,454; Massachusetts, 2,243; Illinois, 1,907; Ohio, 1,837; New Jersey, 1,115; and Connecticut, 1,011. The patents issued to citizens of foreign countries numbered 1,549. The total expenditures on account of the office were $1,024,378.85, and the receipts were $1,188,089.15, or a surplus for the year of $163,710.30. The accumulated surplus in the treasury of the United States on account of the Patent fund amounted, Jan. 1, to $2,945,405.58, there having been but seven years since 1838 which failed to add to the accumulation.

The Commissioner again points out the great need that there is for more room and a larger force for the proper transaction and prompt disposal of the work of the Patent Office—matters which have been repeatedly brought to the attention of Congress. It is extremely hard to understand the hesitation and apparent reluctance of that body to make the needful provisions for the growing business of the office, while its receipts have been so steadily in excess of the expenditures; and, as this is a long session, it is to be hoped that more careful consideration will be given the subject than it received in the last Congress. The Commissioner further suggests an increase in the price of the *Official Gazette*, which is now twice as large as it was when it was started for $5 a year, and also recommends that the Patent Office itself be intrusted with the photo-lithographic work of printing it, which is now done under contract by outside parties. A laboratory for the special testing of electrical apparatus is likewise suggested as a desirable addition that should be made to the facilities of the office. The inventions coming into the office were, thirty years ago, divided into but thirteen classes, whereas they now comprise 177 distinct classes, and the distinctions which are constantly required to be made have become so nice that the greatest care and skill are necessary to determine accurately what is new and what is old. Congress should no longer trifle with the needs of this important and always self-sustaining department of the Government, and it is hoped the Commissioner's suggestions will be heeded before the session closes.

IN packing bottles in cases for transportation, India rubber bands slipped over them will prevent breakage.

NIGHT SKY—FEBRUARY AND MARCH.

BY RICHARD A. PROCTOR.

The Great Bear (*Ursa Major*), with its Dipper and Pointers, is now high up in the northeastern sky. The Pointers direct us to the Pole Star, α of the Little Bear (*Ursa Minor*). A line from the Pole Star to the Guardians of the Pole (β and γ) lies in the position of the minute hand of a clock 18 minutes after the hour. The Dragon (*Draco*) extends from between the Bears to the horizon—east of north—where its head with its two bright eyes can be seen.

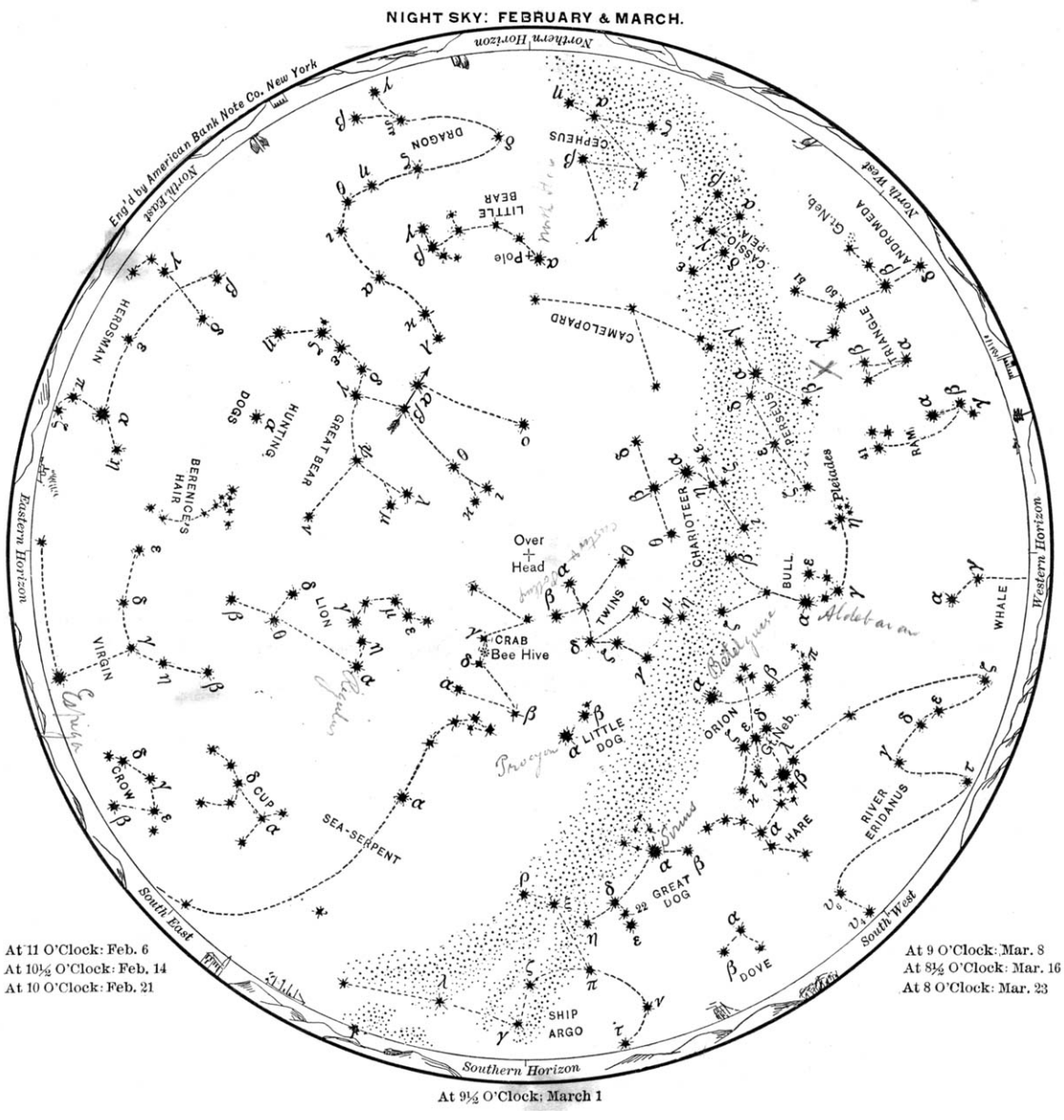
Cepheus is low down, somewhat to the west of north; his Queen (*Cassiopeia*), the Seated Lady, beside him (α and β mark the top rail of her chair's back); while above her lies the poor constellation *Camelopardus*, the Giraffe.

Andromeda, the Chained Lady, is in the northwest, low down—in fact, partly set; the Triangle, and next the Ram (*Aries*), beside her, toward the west. Above them is *Perseus*, the Rescuing Knight; and above him, somewhat to the west, the Charioteer (*Auriga*). The Bull (*Taurus*), with the Pleiades and the bright Aldebaran, is in the mid-heaven, due east; *Gemini*, the Twins, higher, and toward the southwest. Orion, below them, is already slanting toward his grave, low down in the west; beneath him the Hare, and in the southwest a part of the River (*Eridanus*).

Due south is a part of the Star Ship (*Argo*), beside which, low down, is the foolish Dove (*Columba*), while above leaps the Great Dog (*Canis Major*), with the splendid Sirius, chief of all the stars in the sky, marking his mouth. High up, a little west of north, is the Little Dog (*Canis Minor*), and higher, a little east of north, the Crab (*Cancer*), the dark constellation, as it was called of old, with the pretty cluster, *Prosepe*, or the Beehive.

The Sea Serpent (*Hydra*) is rearing his long neck high above the horizon, bearing, absurdly enough, on his back Noah's Cup (*Crater*) and Noah's Raven or Crow (*Corvus*).

Nearly due east, the Virgin (*Virgo*) has risen, Spica shining brightly just above the horizon. The Lion (*Leo*) occupies the midspace above; the "Sickle in the Lion"—its handle marked by η and α, its curved blade by γ, μ, and ϵ—will at once be recognized. The Hair of Queen Berenice (*Coma Berenices*) is nearly due east, and fairly high. Between this small but remarkable group and the Great Bear lies Hevelius' foolish constellation, the Hunting Dogs (*Canes Venatici*). Lastly, in the northeast, the Herdsman (*Bootes*), with the orange-yellow brilliant Arcturus, is rising, though at present, paradoxical as it may seem, he lies on his back.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed; counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

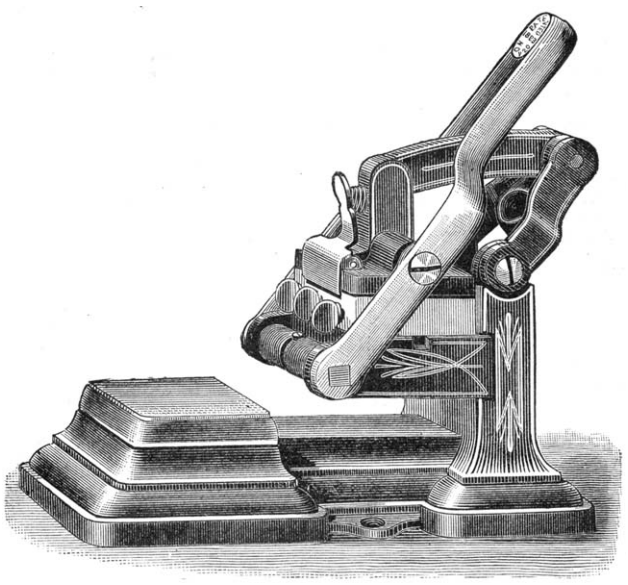
A Georgia Willow Farm.

About a mile below the city of Macon is the osier willow farm of Mr. I. C. Plant, which has been visited by a correspondent of the *American Druggist*. The willow switches, at the end of two years, are from four to seven feet long, and are cut and gathered into bunches like sheaves of wheat. In the stripping building they are steeped in water, and the bark at the larger end loosened for a couple of inches by machinery. The leaves and bark are then removed by a little machine devised by Mr. Plant. One by one the switches are placed in the mechanical stripper, and with a pair of pliers are pulled through with a sudden jerk. They are then wiped off with a woolen cloth, bundled, and laid away to dry.

All the leaves and bark are dried and baled. They are used for medicinal purposes, and command a price of twenty-five cents a pound. There are at present 400,000 willows growing on the farm, and 80,000 additional slips have recently been set out. The entire levee is to be eventually covered with them, when sixty acres will be devoted to this single crop. The average yield is a ton to the acre. When dried, the willows command $200 per ton, and find a ready market.

IMPROVED COUNTING-HOUSE STAMP.

We herewith illustrate a printing stamp of novel construction, which possesses many important advantages, the chief of which is that its printing is of superior quality. It does not require to be replenished with ink oftener than once in six months or a year. It is noiseless and almost frictionless in action, and instantly adjusts itself to a change from one die to another, either with or without changeable dates, and is especially fitted to use the well-known interchangeable metal-bodied rubber type, by means of which any required printing die may be quickly set up on the spot for immediate use. The ink fountain is so



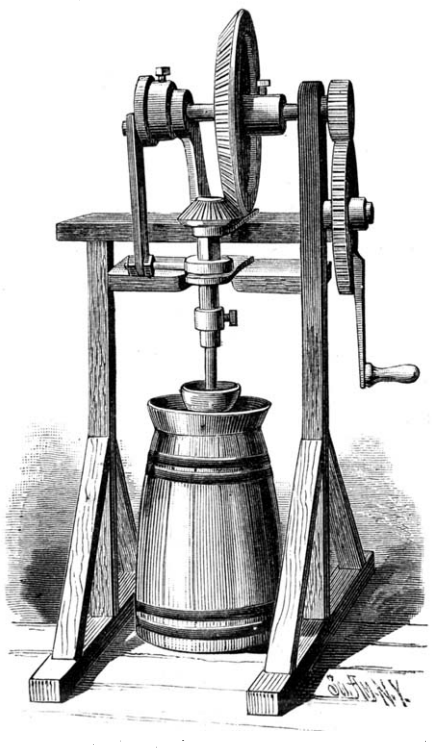
IMPROVED COUNTING-HOUSE STAMP.

formed that by properly charging it the stamp is capable, it is stated, of giving fully 200,000 fine impressions, while the ordinary ribbon dating stamp will give from an inking ribbon of best quality not over 10,000 impressions, and to obtain those the ribbon must be moved along to a fresh spot fully 200 times, each of which moves requires as much time as to reverse the inking cushion in the new stamp, which need be done not oftener than once for each 10,000 to 20,000 impressions. To print with this stamp, instead of striking a blow or pushing down a plunger, a lever is pulled forward by thumb and finger, moving the printing die, which is guided by a parallel motion, from the inking cushion to the impression bed, and, upon releasing, is instantly returned to place by a spring, restoring the printing face of the die to contact with the inking cushion.

The engraving shows the stamp as adapted to general use; another style is made, especially adapted to the use of banks and bankers. It is the invention of Mr. R. Hale Smith, and is manufactured by the R. H. Smith Mfg. Co, 295 Main Street, Springfield, Mass., who may be addressed for further information.

AN IMPROVED CHURN.

A butter making apparatus which is simple in construction, easily operated, and can be readily adapted



LUCAS & DOOTSON'S IMPROVED CHURN.

for use in any ordinary form of churning vessel, is illustrated in the accompanying engraving. The head of the dasher shaft is made in two parts, connected together by a sliding coupling, and a pitman with a collar and arm is connected to the crank head to act upon the lower end of the dasher shaft head, so that when the crank handle is turned the dasher blades will be given both a rotary and a reciprocating motion. The dasher blades may consist of the usual crossed pieces, the number depending upon the amount of cream or the size of the churn barrel, and by simply alternating the direction of rotation, by throwing the crank back and forth in the arc of a circle, the agitation may be somewhat increased.

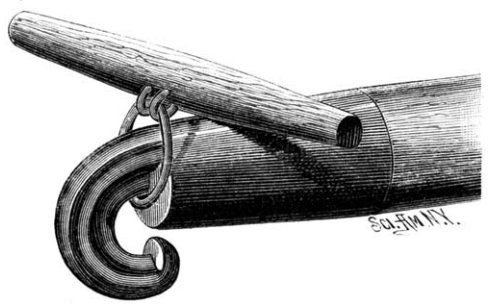
This invention has been patented by Messrs. Robert Lucas and William Dootson, of Athens, Ga., the former of whom should be addressed for further particulars.

Poultry Breeding in France.

L'Illustration gives the following statistics relating to poultry in France; it appears from these that the poultry yards in that country represent a very large capital. The number of fowls is estimated at 45,000,000, which, valued at 2½ francs each on the average, would amount to 112,500,000 of francs. The number of laying hens is taken at 34,000,000, and taking the number of eggs laid by each at an average of 90 yearly, the total production of eggs in France would not fall short of 3,000,000,000, which, at an average of 5 cents each, would amount to 150,000,000 francs. Of this number it is calculated that 100,000,000 of eggs are hatched, of which 10,000,000 die as young chickens, 10,000,000 serve for reproduction, while 80,000,000 of chickens serve for food, which, valued at 1½ francs each, would represent 120,000,000 francs. To these figures must be added an extra value of 6,000,000 for capons. Altogether, the value of poultry and eggs produced in France may be taken at 300,000,000 francs, or $60,000,000.

AN ATTACHMENT FOR POLES OF TWO-HORSE WAGONS.

This device consists of a hollow metal cap or socket applied to the front end of the pole or tongue of a wagon, with a downwardly and backwardly projecting hook, for use in connection with the neck yoke, a ring or loop through the hook safely connecting the neck yoke with the pole, which can with this device be made shorter than heretofore. The neck yoke is thus prevented from working off the tongue in case of accident to the harness, and the lines or reins are not so liable to work over the end of the pole, as often occurs when



COOK'S NECK YOKE ATTACHMENT.

loosing the reins to allow the horses to drink from streams or troughs. The attachment should be made of the best iron, that it may be light and neat as well as strong.

This invention has been patented by Mr. Richard T. Cook, of Virginia City, Montana Territory.

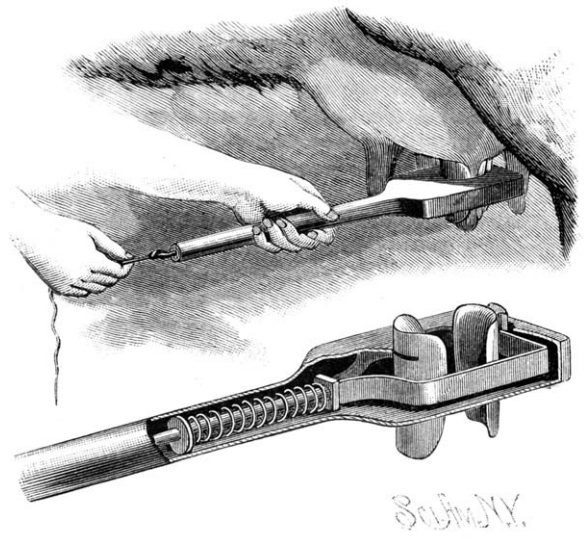
A Curious Shipwreck.

A daily paper gives the following account of a singular shipwreck from the lips of Captain White, of the brig Ada L. White, which was abandoned and lost on her recent voyage from Rio Janeiro to this port. Captain White said it was fine summer weather, with the mercury standing at 80 degrees in the shade, when they left Rio, December 16, with 11,248 bags of coffee on board. The voyage continued without incident until the brig was off Jamaica, when a gale came howling from the northwest, and lasted for three days. But it was several days later, when 160 miles out at sea, off Hatteras, that the great storm which wrecked them was encountered. The waves ran high; the wind blew almost a hurricane, and lashed the ocean into foam; wave after wave broke over the ship, and finally enough water got below to wet the cargo. Then the coffee began to swell, the bags burst, and more water got in. The coffee, which was forced out of the open sacks, floated into the pumps, and soon disabled them. It was now impossible to reduce the water in the hold.

Meanwhile the fury of the storm increased, and the sea was terrible to behold. In the midst of these scenes of peril, a new and terrible danger appeared. Because of the disabled pumps, which were choked with coffee, the eleven thousand bags of coffee became completely saturated, and the whole mass rose like yeast. With a shock that shook the vessel to her center, the decks burst open with a crash of thunder. The hatches were wrenched off as if they were but paper, and great seams opened in the vessel, which admitted the sea in torrents. All hope was now lost. Nothing was to be done but leave the ship as speedily as possible, for she was already settling in the white waters.

A NOVEL DEVICE FOR MILKING COWS.

The engraving herewith so fully illustrates the working of a novel milking device that may be used by unskilled persons, that but little further description is necessary. The apertures through which the cow's teats pass have India-rubber clamping plates on their sides, of a general semicircular form, so that, as the jaws are worked by pulling back and releasing the spring, their surfaces will press upon the teats with an elastic and springing motion, intended to be an imitation of the pressure exerted by hand milking, that will not distress the animal. Two, three, or four of these milkers may be adjusted and held in one hand, where



ROTH'S COW MILKER.

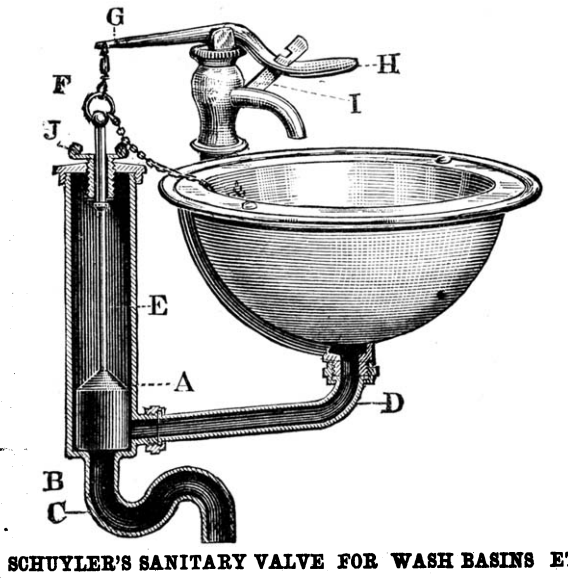
the cow is sufficiently gentle, and the spring cords pulled simultaneously, thus greatly shortening the time of milking. This invention has been patented by Mr. Reuben D. Roth, of Mummasburg, Pa.

Discipline.

In the long run, says President Carpenter of the Drake University, it will be found it is early, thorough, and persistent discipline that tells. Now and then, genius, aided by extraordinarily favorable conditions, blazes forth into some kind of temporary success and notoriety. But the possessors of such fame are almost certain to eventually settle back to their merited place of mediocrity. No man can truly be said to be great when fame rests upon an accident or upon a single achievement. It is the slowly but well-built tower of work and character, reared piece by piece, during a whole lifetime, that forms the enduring monument of real greatness.

SANITARY VALVE FOR WASH BASINS, ETC.

The engraving shows a simple attachment for wash basins, the use of which most effectually prevents the escape of sewer gas into the apartment. The waste pipe, D, enters the valve cylinder, to the bottom of which is attached the pipe leading to the sewer. The valve seat is below the outlet of the pipe, D, so that when the valve, A, is seated, there is no inward escape of gas. The upper end of the valve stem, E, is united by a chain with the end of a lever, G, pivoted so as to operate the valve controlling the water supply. The notched bar, I, passes through a slot in the opposite arm of the lever, and is used to hold the valve at any desired height. When seated, the valve can be locked



SCHUYLER'S SANITARY VALVE FOR WASH BASINS ETC.

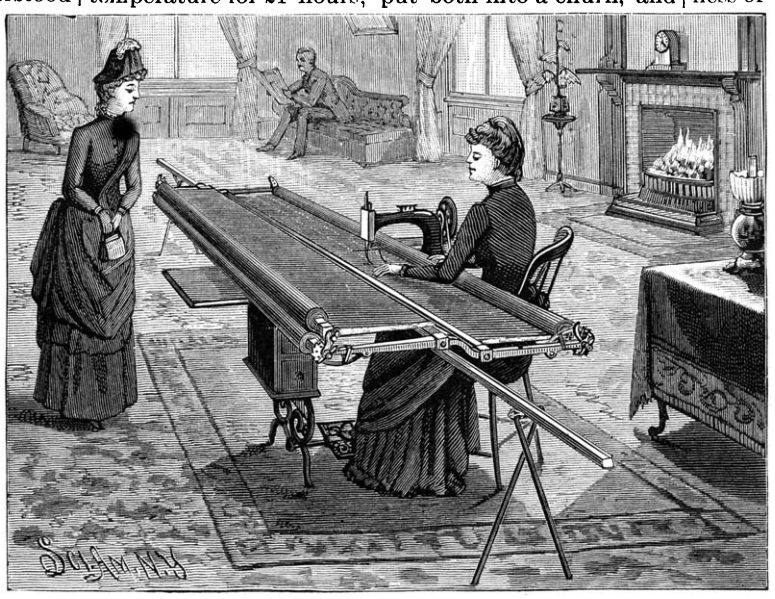
in place by the screw plate, J, and when so secured it forms a permanent seal, which may be left for an indefinite period.

This attachment is the invention of Dr. W. D. Schuyler, of 264 W. 57th St., New York city, and, in addition to its simplicity and reliability, it may be easily applied to any basin in use.

DAVIS' QUILTING FRAME.

The engraving shows a new and valuable attachment for all family sewing machines. By its use one lady can make a full size quilt within two hours, a heavy comfortable in one hour, can also quilt children's winter cloaks, bonnets, dress skirts, and coat linings, and do all manner of quilting, from the largest size quilt to the smallest cloak. It is easily understood and operated. The lining of the article to be quilted is rolled up on one of the outside rollers, and the top of the quilt is rolled up on the top outside roller, and when the cotton or wool is to be placed on the lining, the top roller is lifted out of its place and laid back on the machine table, and the cotton placed on the lining, and then the top roller is returned to its place; these operations are repeated until the quilt is finished.

This quilting frame is manufactured by the Davis Quilting Frame Co. Further particulars can be had from the inventor, Mr. Henry T. Davis, 182 and 184 West Houston Street, New York city.



DAVIS' QUILTING FRAME.

Antiquity of Wheat.

President Charles Barnard, in an article in the *Century* for January, says that the wheat plant is one of the oldest in cultivation. The Chinese recorded its culture as early as 2700 B. C., and it is one of the prehistoric plants, remains of wheat seeds being found in the ruins of the houses of the lake dwellers. While there are several races of wheat, and while these have been crossed, producing hybrids, it has retained its true character, and been entirely independent of other plants since its culture began. Compared with wheat, rye is a modern plant. It is not figured on any Egyptian monuments, and seems to have been first cultivated in the Roman empire about the beginning of the Christian era, though it may have been known somewhat earlier in Russia and Tartary. While these two commercial plants have been cultivated side by side for centuries, the first plants appearing to be true hybrids between them bore seeds this year in this country. Wheat and rye may have been crossed before, yet there appears to be no record of anything like the results here obtained.

Art of Making Butter.

Under this title the Patent Office has lately granted a patent to Lyman Guinnip, of Chicago, Ill., for the following:

Take, say, one gallon of cream, keep it in temperature of 60 deg. to 64 deg. for 36 hours, or so that it will clabber; take another gallon of cream, keep in same temperature for 24 hours; put both into a churn, and churn one minute. Then turn out one-third of the mixture and put one pound of butter into this one-third and stir well and let it stand, while you continue churning the two-thirds remaining until seeds of butter appear; then add or put in eight pounds of butter and churn four minutes; then return the one-third which you had previously taken out, and churn the whole until butter is made. If you desire to color the butter, this should be done just before you cease churning.

To make butter from milk only, you follow the same process, and keep the proportions the same. I use no chemicals whatsoever, and make the butter pure and sweet from milk or cream only. The butter put into the churn, if it be of an inferior quality, will come out vastly improved, the rancid part disappearing with the water of the milk.

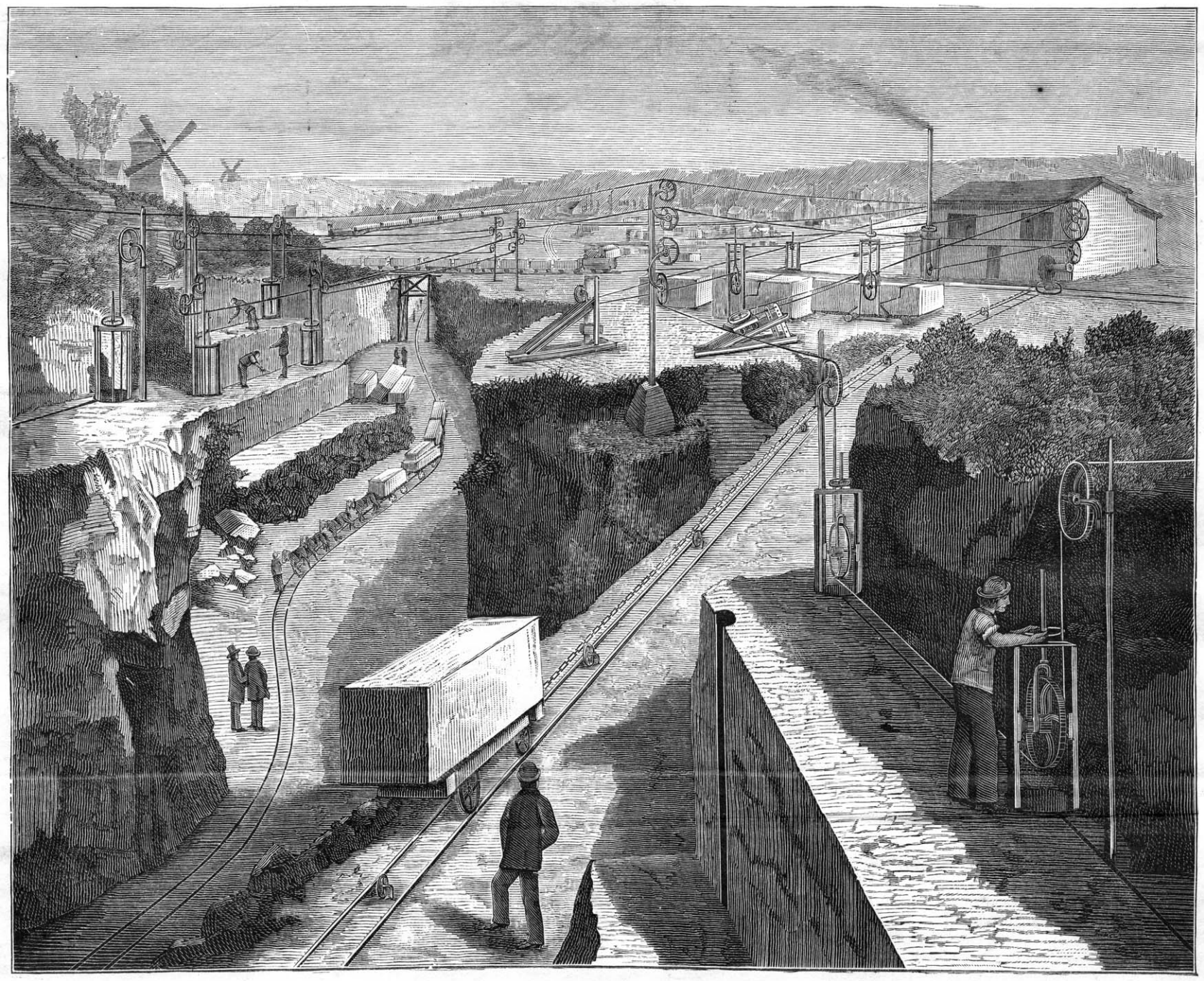
THE HELICOIDAL OR WIRE STONE SAW.

The sides of solid bodies, whatever be the degree of hardness, and however fine the texture, possess surfaces formed of a succession of projections and depressions. When two bodies are in contact, these projections and indentations fit into one another, and the adherence that results is proportional to the degree of roughness of the surfaces. If, by a more or less energetic mechanical action, we move one of the bodies with respect to the other, we shall produce, according as the action overcomes cohesion, more or less disintegration of the bodies. The resulting wear in each of them will evidently be inversely proportional to its hardness and the nature of its surface; and it will vary, besides, with the pressure exerted between the surfaces and the velocity of the mechanical action. We may say, then, that the wear resulting from rubbing two bodies against each other is a function of their degree of hardness, of the extent and state of their surface, of the pressure, of the velocity, and of the time.

According as these factors are varied in a sense favorable or unfavorable to their proper action, we obtain variations in the final erosion. Thus, in rubbing together two bodies of different hardness and nature of surface, we obtain a wear inversely proportional to the hardness and state of polish of their surfaces. Through the interposition of a pulverized hard body we can still further accelerate such wear, as a consequence of the rapid renewal of the disintegrating element.

The gradual wear effected over the entire surface of a body brings about a polish, while that effected along a line or at some one point determines a cleavage or an aperture.

The process usually employed in quarries or stone-yards for sawing consists in slowly moving a stone saw backward and forward, either by hand or machinery, and with scarcely any pressure. Mr. P. Gay, of Paris, has, however, devised a new process, which is based upon the theoretical considerations given above. His *helicoidal saw* is, in reality, an endless cable formed by twisting together three steel wires in such a way as to give the spirals quite an elongated pitch.



APPLICATION OF GAY'S STONE SAW IN A MARBLE QUARRY.

The apparatus in its form for cutting blocks of stone into large slabs consists of two frames, placed several feet apart, each formed of two iron columns, 7½ feet in height, fixed to cast iron bases. The upper part of the frame supports a transmission composed of gear wheels and a pitch chain. Along the columns of the frame, which serve as guides, move pulley carriers. The pulleys are channeled, and receive the cable, which serves as a helicoidal saw. The carriages are traversed by screws, which are fixed between the columns. The extremity of the axle of the pulley to the right is threaded, and actuates a helicoidal wheel, which transmits motion to the wheel. The transmission, completed by the wheels and the pitch chains, is designed to move the saw vertically, through the simultaneous shifting of the carriages. A tension weight, through the intermedium of pulleys, permits of keeping the saw taut. A reservoir, at the upper part of the frame, contains the water and sand necessary for sawing. The feeding is effected by means of a rubber tube, terminating in a flattened rose, which is situated over the aperture made by the saw. A small pump, over the reservoir, raises water. The sand is put in by hand.

A system of rails and ties supports the carriage, upon which is placed the block of stone to be sawn. When one operation has been finished, and it is desired to begin another, it is necessary to raise the pulley carriers and the saw. In order to do this quickly, there is provided a special transmission, which is actuated by hand, through a winch.

The work done by this saw is effected more rapidly than by the ordinary processes, and certain very hard rocks, usually regarded as almost intractable, can be sawed at the rate of from one to one and a half inches per hour.

For sawing marble into slabs of all thicknesses, the arrangement described above may be replaced by a system consisting of two drums having several channels to receive as many saws, or two corresponding series of channeled pulleys, independent of each other, but keyed to the same axles. When the pulleys have been properly spaced by means of keys, the whole affair is rendered solid by a bolt. The extremity of the axles forms a nut into which pass vertical screws. These latter are connected above with cone wheels, which, gearing with bevel wheels keyed to the shafts, secure a complete interdependence of the whole. The ascending motion, which is controlled by endless screws and the helicoidal wheels, is in this way effected with great regularity.

The power necessary to run this kind of saw is less than $n \times \frac{1}{4}$ H. P., on account of the number of passive parts. The most interesting application of the helicoidal saw is in the exploitation of quarries. Our engraving represents a Belgian marble quarry which is being worked by Mr. Gay's method.

Tubular Perforators.—Mr. Gay has rendered his saw completer by the invention of a tubular perforator for drilling the preliminary well. It is based upon the same principle as the Leschot rotary drill, but differs from that in its extremity being simply of tempered steel instead of being set with black diamonds. A special product, called metallic agglomerate, is used instead of sand for hastening the work.

The apparatus consists of an iron plate cylinder, 27½ inches in diameter, and of variable length, according to the depth to be obtained, and terminating beneath in a steel head of greater thickness. This cylinder is traversed by a shaft, to which it is keyed, and which passes through the center of the aperture drilled. This shaft is connected with the cylinder through the intermedium of cross bars, and transmits thereto a rapid rotary motion, which is received at the upper part from a telodynamic wire that passes through the channel of the horizontal pulley. This latter is supported by a frame consisting of three uprights, strengthened by stays, fixed to the ground.

In order that the cylinder may be given a vertical motion, cords, fixed to a piece loose on the hub, wind round the drum of a windlass, after passing over the pulleys.

The rapid gyratory motion of the cylinder, along with the erosive action of the metallic agglomerate, rapidly wears away the rock, and causes the descent of the perforator. During this operation a core of marble forms in the cylinder. This is detached by lateral pressure, and is capable of being utilized. The tool descends at the rate of from 20 to 24 inches per hour, or from 8 to 10 yards per day in ordinary lime rock.

Our engravings, for which and the above particulars we are indebted to *Le Genie Civil*, show the application of the system to quarry working, where all of the various saws and drills are operated by a single engine, with which they are connected by wires as represented.

THE lowest recorded temperature, 393° below zero F., has been produced by Olszewski, by vaporizing liquid nitrogen under low pressure.

Rattlesnakes and Their Peculiarities.

BY HENRY GUY CARLETON.

There has been more fiction than truth written about the rattlesnake, and by the public at large he is as little understood or appreciated as are those larger and more fanciful ophiological curiosities said to be sometimes discovered by convivial gentlemen in their boots. He is simply known to be a bold and bad reptile, with a musical tip to his tail; is popularly supposed to warn thrice before striking once; and, according to paragraphs widely disseminated by the daily press, infests remote ravines and caves in miraculous numbers, and is there slaughtered by the natives partly for fun and partly for his oil, which is said by old women and other eminent medical authorities to possess curative virtues in an invaluable degree. It is likewise asserted that the rattle is a sort of calendar, by which the snake reckons up his age, he promptly adding one button each New Year's day that finds him alive. In reality, he grows two or three rattles a year, if he wishes them. Also, it is claimed that the only refuge for the victim of a rattlesnake's bite is a violent state of intoxication. This recipe is clearly of homeopathic origin, for the venom of the real snake which did the biting must evidently be supposed to be counteracted by that of the imaginary serpents which the demijohn will assist the bitten gentleman to discover. Whisky, however, is an excellent remedy, taken either before or after the bite.

In truth, the rattlesnake is quiet and unobtrusive, minding his own business, and merely asking to be let alone. In the early summer he thaws himself by liberal exposure to the sun, and soon shakes off the torpor of his long sleep, and proceeds to fatten up. Later in the season he seeks the shade, and is not averse, on hot days, to lying at full length in water of pleasant temperature, especially in pools abounding with frogs, where he may combine bathing with luncheon. His rule of diet is simply to eat all he can get, his favorite edibles being birds, frogs, and field mice, which he steals upon and catches with great dexterity.

Birds which nest in trees are safe from his ravages, unless curiosity or accident brings them within his reach, but those which nest in low bushes or on the ground fill him with dinner and satisfaction. If the parent bird is alert and discovers him, the rattlesnake compensates himself by cheerfully devouring the eggs or the brood. Generally, the mother that is or is to be resents what she justly considers an impertinent intrusion, and once within striking distance is added to the bill of fare. All birds hate the rattlesnake, but nearly all will foolishly undertake to fight him, and this is the foundation of the absurd theory that the rattlesnake "charms" his prey. A snake has no more power to charm a bird than a rabbit has to play the fiddle. I have several times been a witness of encounters between snakes and birds, and each time have been convinced that the bird was endeavoring to frighten the snake from her nest, or to punish him for his larceny.

We all know that birds are not cowards. I have frequently seen two or three small finches attack a hawk or an eagle, and make his life a burden to him, even going so far as to perch on his back and make him a bald eagle, whether that was his species or not. An English sparrow will cheerfully undertake to thrash a bird four times his weight, and even the mild-mannered dove will fight the intruder who enters her cote, be he cat or man. A bird's confidence of flight makes her rash in regard to snakes. She sees a rattlesnake near her nest, and at first takes wing; but on observing the lethargic quality of her opponent, proceeds to sit on a convenient twig and scold. Meanwhile the snake has lazily invaded the nest. Having exhausted all the profanity she knows, and emboldened by the snake's sluggishness, the bird comes nearer, wings outstretched and quivering, feathers ruffled, and beak open—all symptoms of anger, not fear. The snake slowly gathers for a spring, and remains perfectly still. Each moment of his inaction serves to make the bird more aggressive, and tempts her nearer. At last the dead-line is reached, there is a lightning-like straightening of the hideous folds, and the poor little misguided warrior feels the stab of those dreadful needles whose touch is death. If she had had as much horse-sense as pluck in her pretty pate, she would have taken the matter philosophically and gone off and laid more eggs, and laid them in a high tree, instead of staying for a row. But ladies are the same the world over, whether in feathers or not. One thing is certain—when a snake captures a bird, he does it less by his own prowess than by the natural tomfoolery of the bird, and he certainly effects nothing by "charming."

Another picturesque error regarding the rattlesnake is the supposition that when spoiling for a fight he coils himself up like a doughnut or a halyard on board of a man-of-war. The snake simply gathers himself in irregular folds, like a series of superimposed S's. It is also alleged that he can spring to immense distances—ten feet, may be—and so attack his victim in midair. This is another lie. A snake can at best strike at three-fourths of his own length, and rarely accomplishes that in actual warfare. I attacked an eight-foot rattlesnake in Texas with a four-foot stick, and got decidedly the best of it. It is also preposterous to state that a rattlesnake rattles thrice before he strikes. Let an apostle of this creed step on an able-bodied rattler, and then argue his theory. I have seen a rattlesnake in July lie in the shade and rattle steadily for an hour. He was either amusing himself or perhaps taking a music lesson, for he did not see me, and there was no other enemy in sight, and I am sure he had no intention of biting himself. Again, in New Mexico, I have known a rattlesnake to strike a horse without emitting the least note of warning.

The common or "banded" rattlesnake, *Crotalus durissus*, inhabits the entire country south of the 46th parallel. He is generally inoffensive, except when he has reason to believe that he is in danger, or is actively attacked, when he defends himself as best he knows how. As I said before, his prey is, in the main small birds, mice, and jumpers, but he finds chipmunks, squirrels, and even rabbits palatable, although more difficult to acquire a proprietary interest in. I helped once dissect a rattlesnake with an immense lump amidships, which proved to be a full-sized and half-digested jackass rabbit. The snake's neck was not two inches in diameter, and I leave others to explain how he wrapped himself around that rabbit.

The water rattlesnake, *Crotalus adamanteus*, is a native of the Carolinas and Florida, and is of greater weight and size, often attaining a length of 9 feet. His favorite practice is to lie in the tepid pools of that region, and scare fishermen. He is a rapid swimmer, as indeed are all rattlesnakes, but is lazy on land. It is said that the alligator, although possessing almost as little sense as a Fenian, is intelligent enough to let the water rattlesnake alone, and indeed I have seen the two sharing the same log in a swamp, taking a social sun bath together.

The largest rattlesnakes are in Texas, on the lower Rio Grande, where they sometimes attain a length of 12 feet, and are heavy in proportion. The smallest are the "horned" rattlesnakes of Arizona, New Mexico, and Southern California, which seldom reach a length of two feet. They have two little excrescences over the eyes, and are full of devilment. They have rattles, but seldom use them, preferring to lie half hidden in the sand until stepped on, when they remonstrate. The sand or "desert" rattlesnake is also small, and pretends to be on neighborly terms with the prairie dog, whose burrows he occupies. I have reason to believe that when the rattlesnake inserts himself in the bosom of a prairie dog's family, he does so on fraudulent grounds, and is unwillingly entertained. The prairie dog carries no life insurance, and cannot afford a quarrel, and the snake is mean enough to take advantage of him.

There is a little, brown, and very comical owl who likewise takes up residence with the prairie dog, but he makes at least a show of earning his rent by remaining at the entrance and acting as janitor, politely bowing to everybody who passes. Neither snake, dog, nor owl seems to mind the other's presence, but are exceedingly sociable. The strange companionship is explained thus: The prairie dog's burrow is the only shelter afforded the snake from the intense heat of those arid plains; and as the dog always sinks a well on his premises, it is the snake's only means of getting water, and I have demonstrated to my satisfaction that rattlesnakes speedily perish without it. In return for this hospitality, the rattlesnake takes charge of the census, and thoughtfully prevents the prairie dog from accumulating a larger family than he can conveniently support.

The horned rattlesnake is endowed with the power of moving forward, backward, or sideways with equal facility. It is related that a German naturalist went to Arizona, and one day came across a horned rattlesnake sunning himself on the edge of a prairie dog's burrow. The naturalist had no stick, but was frantically eager to secure the snake, which was retreating down the hole. So he pulled him out by the tail, and then sprang back to avoid unpleasant consequences. The snake again started down, and again was dragged out by the tail. This time the snake cocked one eye at the naturalist, worked his under jaw in a significant manner, and went down tail first. The naturalist went home.

The rattlesnake's sole means of offense and defense is his pair of fangs, which are two slender, needle-like teeth, jutting from the upper jaw just under the eye. In structure, they resemble the point of a hypodermic syringe, but are not quite as useful. A small channel perforates the tooth, conducting the venom from the gland and sac in which it is engendered to within about the tenth of an inch from the point. The point is of pure enamel, is hard, and of proverbial sharpness. When the snake is feeling pleasantly, the two fangs lie flat against the roof of his mouth; but when he opens his countenance for business, they are erected by a set of muscles provided them, and stand at right angles to the jaw. Thus in position, the snake drives them home by darting his head forward, and by a powerful compression of the temporal muscles the venom is injected deeply into the wounds. In rattlesnakes of ordinary size, 3½ or 4 feet, the fangs are about three-fourths of

an inch in length, but I had a pair given me in Texas which measured nearly two inches.

The venom is a thin, clear fluid, resembling serum, of a slightly bluish cast in some specimens and yellowish in others. Its specific gravity is slightly greater than water, in which it is freely soluble. Placed in alcohol, a portion dissolves, and is harmless. The rest coagulates in stringy masses like albumen, and is the poisonous element. Heat coagulates the entire mass easily, and a slightly musky and disagreeable odor is emitted. The venom contains saline matter and phosphates, forming groups of crystals under the microscope, which also detects globules of fatty matter. Acetic acid dissolves it, and keeps its properties unimpaired for years. I accumulated quite a quantity of the venom some years ago, and tried a number of experiments to determine its physiological and chemical properties. It was neutral with both litmus and turmeric. Placed in contact with fresh blood, however, it became rapidly acid, emitted a musky odor, and coagulated fibrin rapidly. It also acted as a putrefacient. I divided a fresh liver, and injected a drop of rattlesnake venom in one half. Exposed under similar conditions, this piece was putrid in a few hours, while the other was untainted for over a day. These two actions give a hint of its deadly quality. First, it acts as an irritant; secondly, coagulating the fibrin and choking up the capillaries, it will produce local thrombosis and act as a mechanical poison; and, thirdly, by its putrefacient effect induce general pyæmia or gangrene in the wounded limb. Thus, also, it can be seen why alcohol is indicated. By stimulating the heart, the blood will flow too rapidly to coagulate, or those filaments of fibrin partially formed will be forced through into larger channels, where they may be redissolved, and the tendency to putrefaction will also be neutralized and checked. The danger from irritation alone is comparatively slight, but even this is lessened by the stimulant.

I rusted several needles with nitric acid, and then gave them a coat of venom, to try some experiments with animals. A mouse, on being punctured in the leg, died in less than a minute, there being but one spasmodic convulsion. Rabbits, a few seconds after the wound was given, gave one wild leap and fell struggling, death ensuing in three or four minutes, the breathing being labored and irregular, as though by paralysis of the pneumogastric nerve. I buried an abundantly coated needle in the thigh of a cur. He emitted a little yelp of surprise, then trotted off unconcerned. Suddenly he stopped, as though he had forgotten something, then tried to proceed, but his hind quarters sagged and refused to move. I approached. His eyes were bloodshot, fixed, and staring, hair erect, lips retracted, and tongue protruding. His respiration was labored and irregular, and he emitted a cry that was half moan, half howl, as with mingled pain and terror. Suddenly he went into a convulsion, which recurred at short intervals for twelve minutes, when he died. Cats behaved more violently, frothing at the mouth and giving vent to terrible cries, death not coming to their relief for thirty minutes or more.

On frogs the effect was electric; the luckless batrachians simply stretched out, quivered, and yielded up the ghost. A goldfish turned belly up in four minutes, and in eleven minutes was dead. A rattlesnake was dosed, and after eight minutes of active contortions gave but feeble signs of life for one hour and ten minutes, and then was still. Post mortem examination showed an anæmic condition of the brain and an engorgement of the ventricle with dark clots, but no other signs. Applying the stethoscope to a dog strapped down and punctured, I found the action of the heart to be at first violent, but regular, and then irregular and weak. Four drops, administered to a dog internally, seemed to have a marked sedative effect, but the symptom soon passed away. I was encouraged by this into taking one drop myself, diluted largely with water and taken through a tube. I fancied there was a slight increase and irregularity of heart action, and certainly muscular relaxation sufficient to produce a marked perspiration, but the effect was temporary. If this experiment should be repeated, I would caution the experimenter to be sure he has no abrasion on lip, tongue, or palate, and that his teeth and gums are sound, or he may have to record symptoms not in the above catalogue of my experience.

I concur in the belief that, admitted to the circulation, rattlesnake virus paralyzes the heart, but I believe the effect is first rather cerebral than directly cardiac. I have no doubt embolism occurs in many cases where the poison has reached a large vein and is carried directly to the heart, exercising its coagulant power there; but this is the exception, and not the rule. At all events, ammonia is indicated, and, in conjunction with a liberal use of alcohol, I believe it to be the best remedy which can be applied. To lance the wound promptly, after tightly binding the injured limb above the wound, would be efficacious in lessening the danger; but in any case whisky and ammonia in small doses, frequently repeated, will be a necessary resort.

I have seen the Apaches on the Tulerosa Reservation, in New Mexico, take a deer's liver, induce a rattlesnake to strike it repeatedly, allow it to get putrid, and then smear their arrow heads with it, but unless freshly used the virus so applied would have no effect. Exposed to air, it quickly loses its properties, particularly when in contact with serum or fibrin.

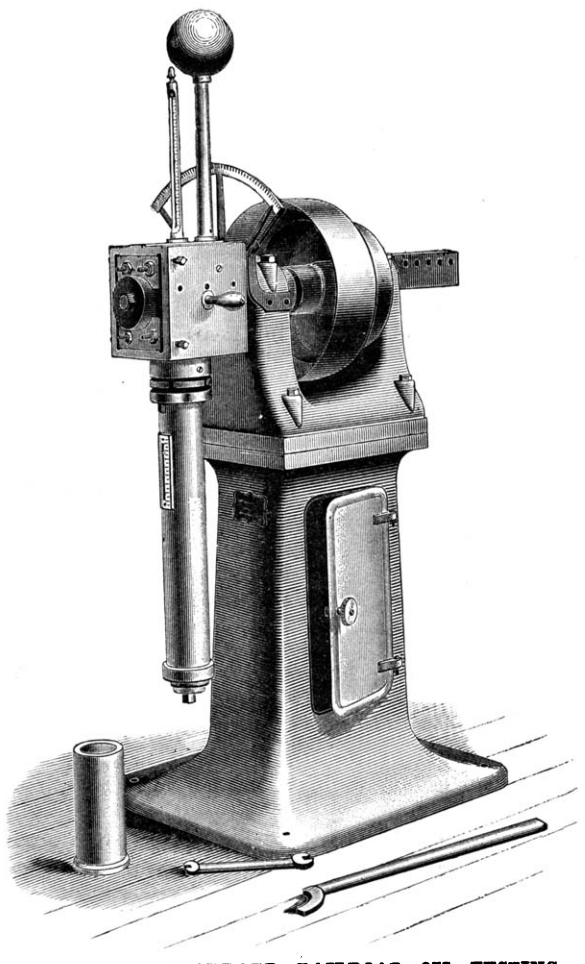
In quantity, the venom injected by a large and active rattlesnake is about four minims, or two for each fang. He can strike twice or thrice in rapid succession with deadly effect, but soon the glands are unable to keep up the supply, and he will require some minutes to recuperate. Snake charmers usually sear the glands with a hot iron, leaving the fangs intact, but only capable of making a slight flesh wound. Too much care cannot be exercised in dissecting a rattlesnake's head, for the glands secrete for some time after death, and a little of the virus goes a long way.

During the hot days of August and September, the rattlesnake is indolent and very ill tempered. This is the season when they are supposed to be blind, but it is laziness, and not ophthalmia, which induces them to wait till they are trodden upon before moving. This is also the time when they lie in the grass near streams to avoid the heat and waylay the frolicsome frog. I suppose trout fishermen know this, for I notice they always carry a bottle of antidote.

In New Mexico and on the Staked Plains in Texas, where the nights are cool, it is the rattlesnake's sociable custom to crawl between a traveler's blankets and snuggle close to him till morning. Numbers of them are killed in camp every year by soldiers campaigning in that section; but as the rattlesnakes never abuse hospitality by biting the sleeper, few accidents happen. Still, there are men who, when out on a hard march, prefer to sleep alone.

THURSTON'S STANDARD RAILROAD OIL TESTING MACHINE.

This machine has been specially designed to provide means for reliable and systematic investigation of



THURSTON'S STANDARD RAILROAD OIL TESTING MACHINE.

the value of the various lubricating oils used in railway service, and for all purposes for which it is essential to reduce to a minimum the friction of bearing surfaces under heavy pressures; securing economy in power required, and determining the best, and consequently the *cheapest*, oils for lubricating purposes.

Additional advantages secured in this machine are those due to rigidity and careful fitting of the separate parts, while the whole machine is arranged with special reference to convenience of operation.

The journal, which is Master Car Builders' standard, 3¾ inches diameter, is a hardened steel sleeve, ground perfectly cylindrical.

The boxes in which this journal runs are of phosphor bronze, and are designed for internal water circulation.

A late improvement includes a thin lining of phosphor bronze or other metal ordinarily used, which can be accurately weighed before and after a test, thus determining the percentage of wear for any given metal and mileage. The linings are made perfectly interchangeable, and can be renewed at any time, or special linings of any other metal or alloy may be inserted, using the same water brasses.

Pressures up to 9,000 pounds are obtained by the use of a heavy helical spring secured within a 4 inch wrought iron pendulum tube. By a convenient taper key adjustment (not shown in the cut), the pressure may be easily and quickly relieved for removal of the pendulum and brasses, for inspection of the latter or of the journal, without release of pressure of the spring by the ordinary means, the latter being, obviously, a tedious operation.

The standard water brasses may be replaced by the ordinary brasses used in freight or passenger service, if desired, giving actual conditions, in this respect, under which the test may be conducted.

Friction at the surface of the journal is indicated on a graduated arc, conveniently placed above the pendulum.

The tendency of friction between the surfaces of the journal and brasses is to rotate the heavy pendulum; hence to give as great a range as possible, and thus render this function an important adjunct, and also to enable the observer to note small variations of resistance, a form of compound pendulum is adopted, as shown in the illustration.

A standard thermometer, graduated 40° to 350° Fah., and Centigrade to correspond, is inserted to indicate, as nearly as possible, the exact temperature of the surfaces in contact. A positive automatic revolution counter is attached, registering up to 1,000,000, affording ready means for determining the comparative mileage run during any investigation.

Speeds corresponding to rates usual for train service, either freight or passenger, are obtained by the use of a countershaft having two pairs of tight and loose pulleys, 10 inches diameter, 6¼ inches face, and 18 inches diameter, 4⅝ inches face, respectively. A two grade cone, 4¼ inches face, gives ample belt efficiency for the four speeds thus obtained. The countershaft should run 150 and 430 revolutions per minute.

An extra journal sleeve of wrought axle iron, wrenches, and countershaft complete, furnished with each machine.

As a valuable office hand-book covering this important subject, we would refer to Professor R. H. Thurston's "Friction and Lost Work in Millwork and Machinery," published by John Wiley & Sons, New York.

This improved testing machine for lubricants is now built by the Pratt & Whitney Company, of Hartford, Conn.

The Metzdorff Pianoforte Improvements.

For many years, pianoforte manufacturers have experimented in the construction of instruments which will mechanically facilitate the transposing of music, so that any given piece may be conveniently played in any desired key, while the player would still use the same keyboard. Such devices heretofore have not been sufficiently perfected, consequently have never obtained wide recognition, although musicians and instrument makers are well aware of the importance and value of a good practical invention of this character. The difficulties hitherto experienced are obviated, it is claimed, by a recent invention of Mr. Louis Metzdorff, of Concepcion, Chili, who has made use of the left pedal, as now found in the pianos of some of our best manufacturers, to raise the hammers and other parts of the action, so as to leave the keys in a vacant space beneath, and permit the lateral adjustment of the keyboard as required. The keyboard is also lengthened for additional keys, and it is so devised that these additional keys are moved under or out from the hollow side parts of the piano case by laterally moving the keyboard in either direction, to the extent of a whole octave, either up or down the scale.

The application of this invention to the instrument does not interfere with or impair the usefulness of any of the many other modern improvements which have imparted to the piano its extraordinary and comprehensive power as an interpreter of musical ideas. The Metzdorff improvements aim to widen the sphere of usefulness of this noble instrument, by adapting it to any varied degrees of musical culture, so that compositions may be more widely brought within the scope of singers whose voices may not cover the scale in which a score had been originally written. It also applies with equal advantage to accompanying other instruments, such as the violin, flute, etc., by adapting itself to their pitch.

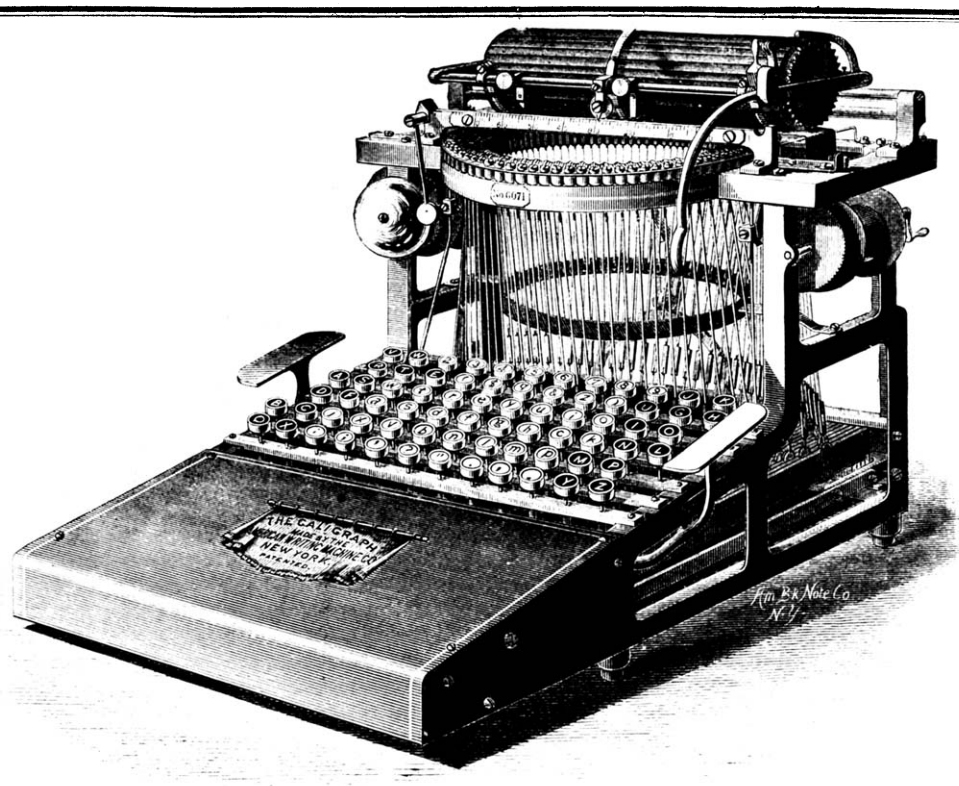
Mr. Metzdorff has obtained a patent on this improvement in the United States and several other countries, and now aims to arrange for its general introduction. Further particulars can be obtained by communicating with Messrs. J. Parker Read & Co., *Tribune* Building, New York, who have for exhibit a piano with this invention applied.

Error in the Balance.

A current of air may be produced if an evaporating fluid in a beaker is placed upon one scale. The error may amount to 0·4 mg. A source of error, less common, but sometimes more serious, is electric action produced by friction of the balance case and consequent attraction of one scale pan. T. E. Thorpe (*Journal Chem. Soc.*) calls attention to small daily fluctuations of the zero point.—*R. Hennig.*

CALIGRAPH WRITING MACHINES.

Ten years ago, writing machines were little used, practically unknown to the great majority of writers, and were held by the few who knew something of them to be mechanical toys rather than the great time and labor savers they have since proved to be. Up to 1881, when the American Writing Machine Company, of Hartford, Conn., introduced the caligraph, double case writing machines were incomplete, being so constructed as to compel the operator to shift the carriage by a gratuitous stroke for capital letters and figures. The caligraph—of which we herewith present several engravings, showing the completed machine and the operations of making the more important parts—prints each character in both capitals and small letters at a single finger stroke. One of the most particular parts is the type bar, as the ease and accuracy with which the machine can be operated depend largely upon the care and skill exercised in its construction.



THE CALIGRAPH.

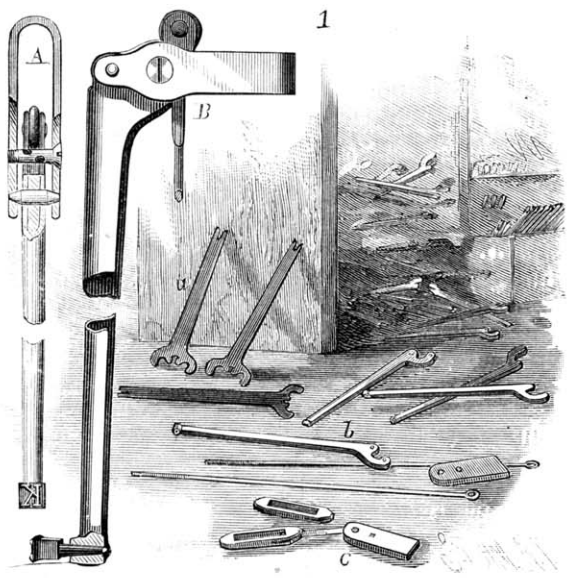


FIG. 1.—THE TYPE BARS

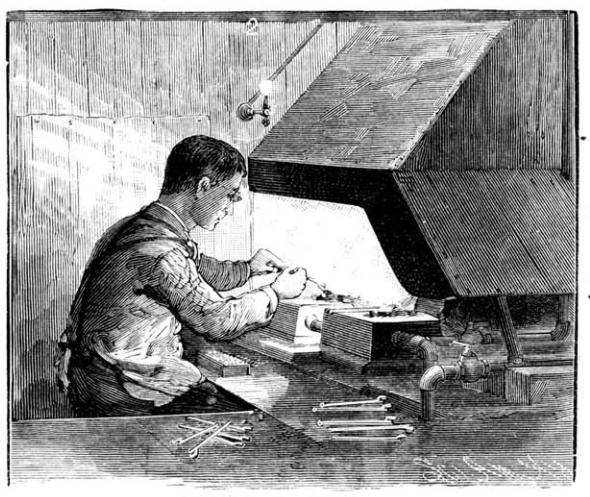


FIG. 2.—BRAZING THE TYPE BARS.

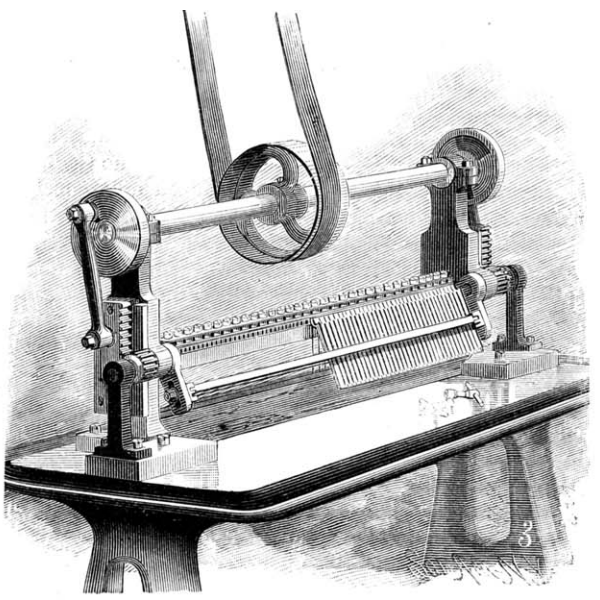


FIG. 3.—TESTING THE TYPE BARS.

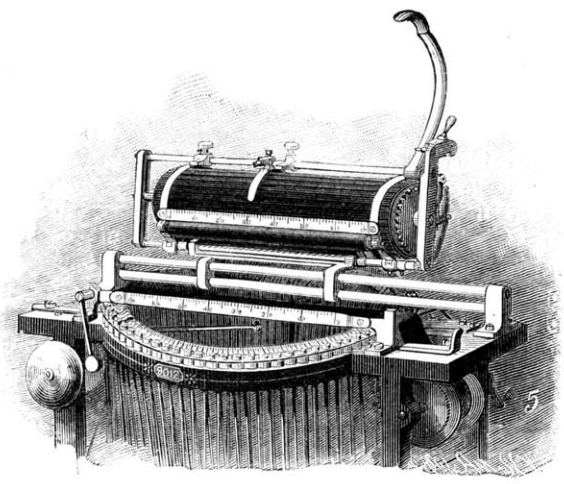


FIG. 5.—THE CARRIAGE TILTED BACK

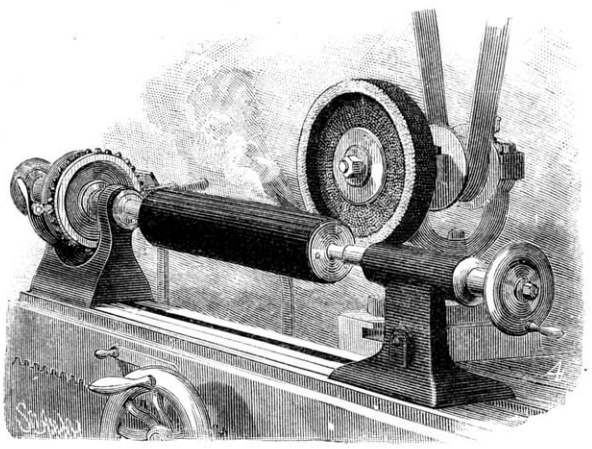
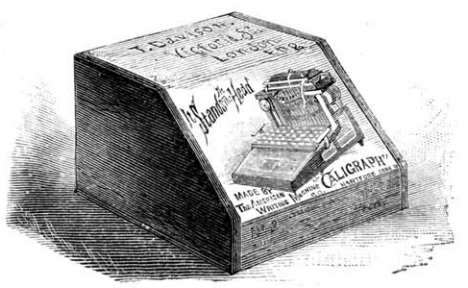


FIG. 4.—GRINDING THE PRINTING CYLINDER.



THE CALIGRAPH CLOSED.

ILLUSTRATIONS OF THE CALIGRAPH INDUSTRY.—AMERICAN WRITING MACHINE CO., HARTFORD, CONN.

The blanks, *a*, Fig. 1, are made of cold rolled steel, folded lengthwise to form the type bar, *b*. After having been folded, a piece of steel is brazed in each end, this operation being illustrated in Fig. 2. The sectional drawing, A, and the side elevation, B, show the type bar pivoted at its upper end on a double coned steel pin held in holes in the shanks of a U-shaped piece or hanger, and carrying at its lower end the removable steel type. Just above the pivot is a screw uniting the two shanks, and formed with holes through its body as shown. By means of a lever inserted in one of these holes, the screw can be turned to bring the shanks together, and thus insure a tight working fit of the type bar on the conical ends of the pin. The holes in the pin are necessary, since, when the type bar is in position, the slot in the screw cannot be reached by a tool. The upper inner ends of the type bars are connected by rods with the inner ends of the pedals. The hangers supporting the type bars are arranged upon a circular frame, as shown in Fig. 5.

After the type bars have been pivoted between the shanks of the hangers, they are taken to the "working jack," Fig. 3. The hangers are placed upon a crosspiece uniting two standards, in the upper ends of which a shaft is journaled. To each end of this shaft is attached a connecting rod operating a slide provided with a rack at one side. These racks engage with pinions mounted on short shafts having crank arms on their inner or facing ends. The outer ends of these cranks are united by a longitudinally slotted rod, through which the type bars are passed. The reciprocating motion of the racks moves this rod rapidly back and forth through the arc of a circle, thereby so working the coned joint as to obtain an accurate and easy movement of the type bars when they are inserted in the machine.

To insure a perfect print, the type must strike on a flat surface. This is accomplished by a platen, or printing cylinder, having a polygonal shape, which presents flat surfaces for the full length of the lines. This hard rubber platen is driven across the top of the machine on casehardened and ground steel rods, the force being furnished by a spiral spring applied in such a way that it unwinds but one-seventh of a turn in moving the platen across the disk, thus making the tension on the carriage practically the same at all points. Fig. 4 is a representation of the machine that automatically grinds these faces on the rubber cylinder. A clear understanding of the arrangement of these faces and how they appear in the machine may be obtained from Fig. 5, which shows the top of the caligraph, with its carriage tilted back.

The works of this company are provided with special machinery for making the various parts, and constant care is exercised to insure the smooth and reliable working of each part. The several parts are made by the same machines, and to the same gauges, thereby obtaining that most essential and desirable feature, interchangeability. These machines are fitted to write in any language, and are said to be extensively used abroad.

Scientific Growth.

Professor Huxley, in his presidential address before the Royal Society last November, said that "of late years it has struck me, with constantly increasing force, that those who have toiled for the advancement of science are in a fair way of being overwhelmed by the realization of their wishes. It has become impossible for any man to keep pace with the progress of the whole of any important branch of science. If he were to attempt to do so, his mental faculties would be crushed by the multitudes of journals and of voluminous monographs which a too fertile press casts upon him. This was not the case in my young days. A diligent reader might then keep fairly informed of all that was going on, without robbing himself of leisure for original work, and without demoralizing his faculties by the accumulation of unassimilated information. It looks as if the scientific, like other revolutions, meant to devour its own children; as if the growth of science tended to overwhelm its votaries; as if the man of science of the future were condemned to diminish into a narrower and narrower specialist as time goes on.

"I am happy to say that I do not think any such catastrophe a necessary consequence of the growth of science; but I do think it is a tendency to be feared, and an evil to be most carefully provided against. The man who works away at one corner of nature, shutting his eyes to all the rest, diminishes his chances of seeing what is to be seen in that corner; for, as I need hardly remind my present hearers, that which the investigator perceives depends much more on that which lies behind his sense organs than on the object in front of them.

"It appears to me that the only defense against this tendency to the degeneration of scientific workers lies in the organization and extension of scientific education in such a manner as to secure breadth of culture without superficiality; and, on the other hand, depth and precision of knowledge without narrowness."

Time Notation.

In the decimal system of time proposed by Professor Loudon, the present day of twenty-four hours is divided into ten periods, so that each of the new hours would correspond to two hours and twenty-four minutes of our present divisions. The ten periods would be again divided into a hundred subdivisions, called minutes, if necessary, and each equivalent to about one and a half of our present minutes. The minutes, again, would be subdivided into 100 seconds, which will thus be seen to be almost the same as the existing second. The advantages of such a system, as given by those in favor of it, are the aboltion of the A.M. and P.M., as has already been accomplished by the system of continuous notation for the whole 24 hours, and the convenience arising from the adoption of a system based on the decimal scale, by which vulgar fractions are gotten rid of, and the use of symbols for the hour, minute, and second avoided. In addition—and this is the consideration particularly urged—the time in hours and minutes would be indicated immediately by the clock, whereas, by the present system, one must consult two hands, and calculate the number of minutes besides.

If the affairs of the world were just beginning, we should say that Prof. Loudon's system was a very good system; but under the weight of the traditions of several centuries, our conception of time is so hopelessly wrapped up in the old-fashioned divisions that we confess ourselves willing to still consult two hands, and even consent to multiply the reading of one of them by five.

PALMERS' STEAM CARRIAGE.

The small steam carriage which we figure herewith, and which was shown at the Antwerp Exposition, is intermediate between Messrs. Dion, Bouton & Trepardoux's steam phaeton and Mr. Peraux's steam tricycle. It is a sort of a road locomotive, that hauls a thirty-three pound carriage, mounted upon steel wheels, and having a seating capacity for two persons. The two side wheels of the tricycle are 4½ feet in diameter, and the front or steering one, 23½ inches.

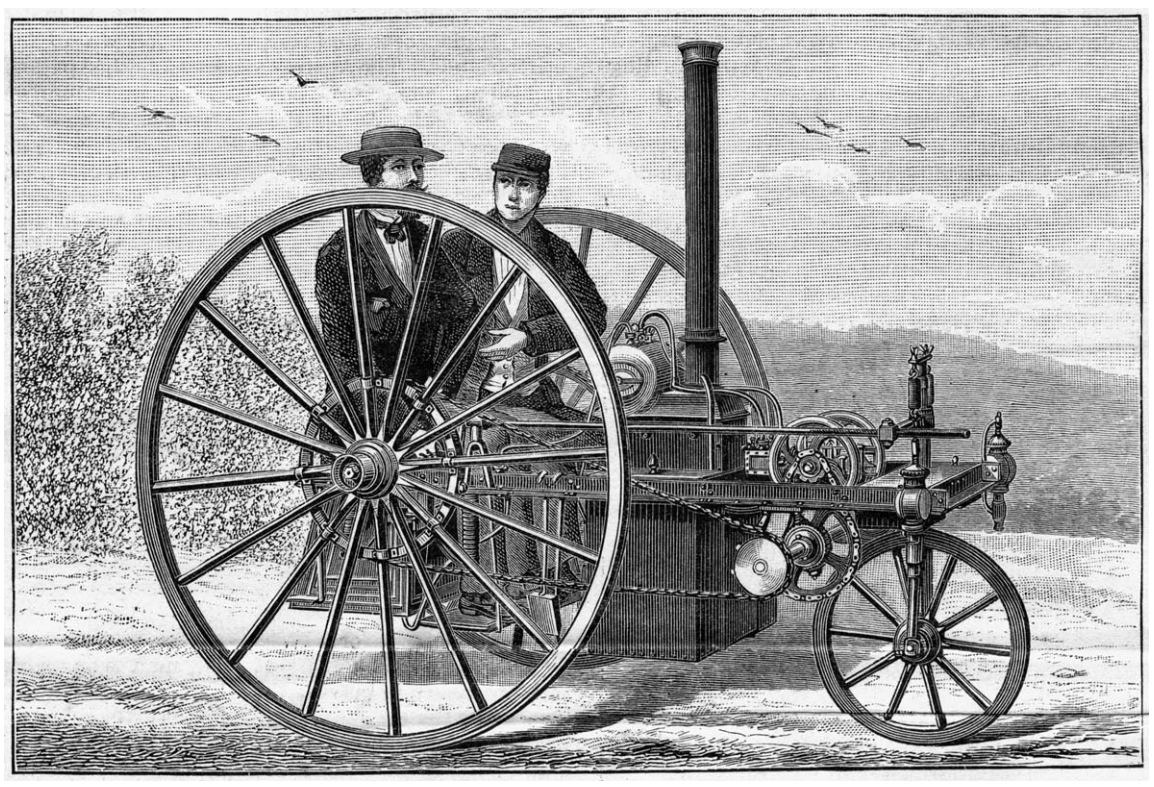
The boiler, which is heated with coke, is of the Temple variety, weighs but 175 pounds, and is of two-thirds horse power. It holds but a few pints of water, and is quickly put under pressure, and, seeing the small quantity of water submitted each instant to the action of heat, constitutes an inexplosive generator of nearly absolute safety. The steam produced actuates a small two-cylinder motor, 16 inches in length by 8 in width, the cylinders of which are 1½ inch in diameter. The stroke of the piston is 3 inches. In order to effect a saving in space and weight, transmission of motion to the shaft of the little engine is performed without connecting rods. To this effect, the piston rods are provided with vertical slots, in which the crank pins slide, as in the Rikkers motor. As the velocity of the motor is very great in proportion to that of the driving wheels, the initial speed is reduced to the proper ratio by an intermediate shaft. The motor is connected with this latter through a pitch chain, and the motion of the intermediate chain is transmitted to the driving wheels by two ordinary chains placed on each side, and at each extremity of the intermediate shaft. In consequence of their flexibility, these chains allow of very yielding springs being used.

The driver has within his reach all the apparatus necessary to keep up the fire, to set the engine running and to stop it, and to steer the vehicle.

The boiler is continuously fed by a pump situated to the left. On the right there is a minute injector, to be used in case of accident.

The fore wheel, which is the steering one, is actuated by a hand wheel and a screw that permits of giving it any direction. An ingenious device renders the vehicle proof against any shock that the steering wheel may receive, and thus insures of the directing of the vehicle, and renders the running of it more easy.

The speed of this carriage is from six to seven miles per hour.—*La Nature.*



PALMERS' STEAM CARRIAGE.

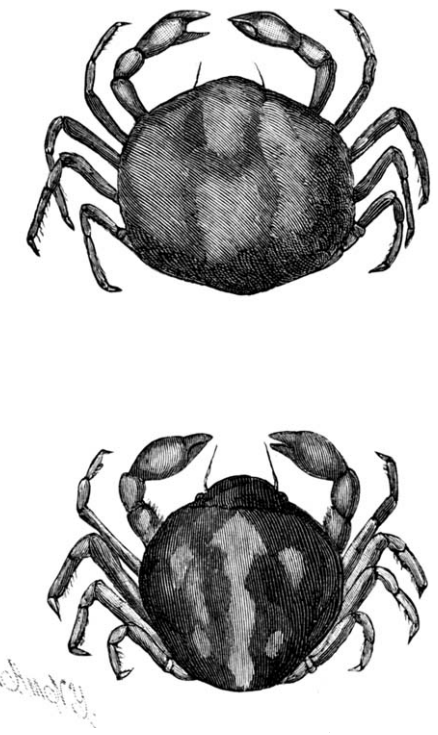
A COMPANY has been formed at Oil City for conveying natural gas from the wells to the cities and large towns in this and other States.

THE OYSTER CRAB.

BY C. FEW SEISS.

I find that the great majority of our people consider the little pink-tinted crab which is found within the shells of our oyster as merely the common crab of the markets in its immature or infant stage. This is an error, for the diminutive crustacean found within the oyster is not only a distinct species belonging to a different genus, but also a mature animal, fully grown. It is the oyster crab, or *Pinnotheres ostreum* of naturalists, and was first described by Thomas Say, in the *Journal* of the Academy of Natural Sciences, of Philadelphia, in 1817.

The oyster crab does not feed upon its host, the oyster, under whose roof it has seen fit to dwell, but upon such nutriment as it can get in the sea water that flows into the open shell of the oyster.



THE OYSTER CRAB.

The mollusk does not seem to be incommoded or to suffer in any way by having a lodger, for such are generally as fat and well-flavored as oysters that live alone. The oyster crab does not work its way into or injure the oyster, but lives only in the gill cavity or between the gills.

It is a rather singular fact that it is only the female crab that has been observed in oysters. Possibly the male may at times be found in a similar situation, but I have as yet failed to find an authenticated instance. The male is comparatively rare, and when seen is generally swimming near the surface of the water.

Various curious opinions have been expressed by writers as to whether these parasitic crabs are injurious or beneficial to their host. Referring to one inhabiting a large mollusk of the Mediterranean, an old writer says: The crab waits until a number of small animals upon which it feeds enter the shell, when he gives the mollusk a pinch, and it instantly closes the valves of its shell, and thus captures the animals, so that the crab can easily catch and devour them. Another one says, as the oyster is blind, and the crab has the power of vision, when the latter observes an enemy approaching he gives warning with his nippers, and the oyster, drawing its shells together, shields both itself and the crab from danger. These opinions, of course, must be taken as guesswork, and not as scientific facts. As I have said, the oyster of our coasts apparently does not suffer in harboring the lodger it has not the power to eject; but, nevertheless, the crab is certainly of no great benefit, and is an intruder and an uninvited guest all the same.

The female oyster crab is covered with a thin, semi-transparent, whitish shell, tinged in parts with pink. The pink color becomes orange after boiling. It measures across the shell or carapax seven-sixteenths of an inch to one-half of an inch.

The male is smaller, being only five-sixteenths of an inch in breadth. The upper surface of his shell is dark brown, with an irregular whitish band across the back, extending backward from above and between the eyes, and a white spot on each side of this band; sometimes, two additional small white spots posteriorly. The legs and under surface of the body are also of a whitish color. The shell of the male is more compact and hard than that of the female. The female of this species has been found inhabiting the oyster from the New England coast to South Carolina. The other species common on our coast is the spotted mussel crab (*Pinnotheres maculatus*), which lives in the shells of the common mussel (*Mytilus edulis*), but, so far as I can learn, has never been found in the oyster.

NATURAL HISTORY NOTES.

Uses of Spines in Cactuses.—Mr. Thomas Meehan considers that one of the uses of spines with which cactuses are covered is to break the full force of the sun on the plant. Plant lovers set out their treasures in summer under arbors of fish netting or galvanized wire, and those who have had experience would be surprised to find how the moving shadows of the twine or wire lower the temperature. A mass of spines on a cactus must certainly have the same effect. A cactus does not need much light on its epidermis to keep it healthy, and Mr. Meehan believes that one use of the spines is to furnish the required partial shade.

Longevity of Ants.—In the November number of the *Contemporary Review*, Sir John Lubbock says the general opinion used to be that ants lived for a single season, like wasps. "Aristotle long ago stated that queen bees live for six, and some even seven years. Bevan, however, observes that 'the notions of both ancients and moderns upon the subject have been purely conjectural. Indeed, it appears to be somewhat doubtful whether the length of life which the former seem to have attributed to individual bees was not meant to apply to the existence of each bee community.'

"The nests, however, which I have devised enable me to throw considerable light on this question. The queen ants are so easily distinguished from the workers that they can be at once identified, while, if a nest be taken in which there is no queen, we can satisfy ourselves as to the workers, because, though it is true that workers do sometimes lay eggs, those eggs invariably produce male ants. Hence, in such a case, the duration of the nest gives us the age of the workers; at least they cannot be younger, though of course they may be older. In this way I have kept workers of *Lasius niger* and *Formica fusca* for more than seven years. But, what is more remarkable still, I have now two queens of the latter species which I have kept ever since 1874, and which, as they were then full grown, must now be nearly twelve years old. They laid fertile eggs again this year—a fact the interest of which physiologists will recognize. Although a little stiff in the joints, and less active than they once were, they are still strong and well, and I hope I may still keep them in health for some time to come."

Red Snow.—At a recent meeting of the Biological Society of Washington, Mr. Romyn Hitchcock, of the National Museum, read a paper on red snow, and exhibited through the microscope specimens of the brilliant, minute crimson globules which give color to the snow, and about the character of which there has been considerable difference of opinion among naturalists. Mr. Hitchcock remarked that the red snow that at

tracted much attention from scientific gentlemen when it was brought home from the Arctic regions by Capt. Ross, in the year 1818, was by no means unknown before that time. De Saussure, as early as 1760, observed it on Mount Breven, in Switzerland, and since then many others have noticed it in the Alps and Pyrenees, and it seems to occur frequently in all parts of the world. Particular interest, however, was manifested in the material brought home by Capt. Ross, and several botanists secured specimens for examination, and, among these, Mr. Francis Bauer, who thought the plant a *Uredo*, and named it *U. nivalis*. Baron Wrangel regarded the plant as a lichen, and gave it the name of *Lepraria Kermesina.*

In the latest literature of algæ the plant is classified as *Chlamydococcus*. Until the method of propagation of this plant is more satisfactorily established, Mr. Hitchcock thinks it will be impossible to fix its systematic position. It is not improbable that in its actively vegetating condition the plant is green. This is indicated by the observations of early discoverers.

A specimen of the red snow collected by Dr. Kane, from the crimson cliffs of Beverley is in the National Museum, but is now thoroughly dry.

A specimen sent by Mr. Alexander McDougall was received in January of this year from Poverty Gulch, Col.

Mr. Hitchcock made a few observations on this and attempted to cultivate some of the cells, but without success. The cells were of a bright red color, sometimes apparently quite naked, but frequently inclosed singly or three or more together, in a colorless, shriveled envelope.

The contents of perfect and fresh cells appeared to be quite clear and transparent, with occasionally a well defined sort of vesicle of a deeper color than the rest. When the endochrome was pressed out from the cells into the surrounding water, it contracted into spherical, oil-like masses. The surrounding envelope was quite hard, tough, and resisting.

Floral Barometers.—The *Illustrite Garten Zeitung* says that the flowers of the well known spiderwort, *Tradescantia zebrina*, always open their flower buds twenty-four hours before rain comes. The plant is placed in a room where it receives the full rays of the sun. When the plant is in a flowering condition, buds follow each other rapidly, and it is very easy to note the facts as stated.

Nectar Secreting Plant Lice.—Prof. A. J. Cook says in *Science:* Oregon is the place for nectar secreting plant lice. During the past fall I received twigs of spruce and willow from that State which, though not more than six inches long, contained at least a tablespoonful of crystallized sugar, which was both pleasant and sweet. This insect is a species of Aphis, and though possibly not equal to the bee, or to the manufacturer of our best cane sugar, in her power to form an excellent article of sugar does surpass greatly the glucose factories in the quality of the product which she turns out.

Wonders of the Sea.

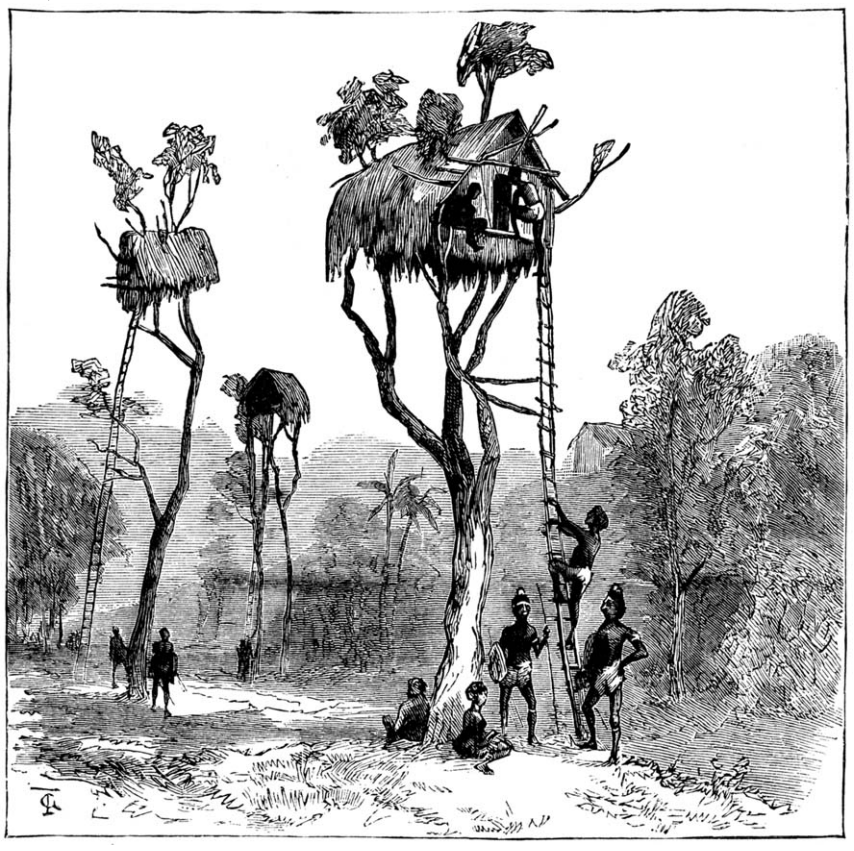
The sea occupies three-fifths of the surface of the earth. At the depth of about 3,500 feet, waves are not felt. The temperature is the same, varying only a trifle from the ice of the pole to the burning sun of the equator. A mile down, the water has a pressure of over a ton to the square inch. If a box six feet deep were filled with sea water and allowed to evaporate under the sun, there would be two inches of salt left on the bottom. Taking the average depth of the ocean to be three miles, there would be a layer of pure salt 230 feet thick on the bed of the Atlantic. The water is colder at the bottom than at the surface. In the many bays on the coast of Norway, the water often freezes at the bottom before it does above.

Waves are very deceptive. To look at them in a storm, one would think the water traveled. The water stays in the same place, but the motion goes on. Sometimes in storms these waves are forty feet high, and travel fifty miles an hour—more than twice as fast as the swiftest steamer. The distance from valley to valley is generally fifteen times the height, hence a wave five feet high will extend over seventy-five feet of water. The force of the sea dashing on Bell Rock is said to be seventeen tons for each square yard. Evaporation is a wonderful power in drawing the water from the sea. Every year a layer of the entire sea fourteen feet is taken up into the clouds. The winds bear their burden into the land, and the water comes down in rain upon the fields, to flow back at last through rivers. The depth of the sea presents an interesting problem. If the Atlantic were lowered 6,564 feet, the distance from shore to shore would be half as great, or 1,500 miles. If lowered a little more than three miles, say 19,680 feet, there would be a road of dry land from Newfoundland to Ireland. This is the plain on which the great Atlantic cables were laid. The Mediterranean is comparatively shallow. A drying up of 660 feet would leave three different seas, and Africa would be joined with Italy. The British Channel is more like a pond, which accounts for its choppy waves.

It has been found difficult to get correct soundings of the Atlantic. A midshipman of the navy overcame the difficulty, and shot weighing thirty pounds carries down the line. A hole is bored through the sinker, through which a rod of iron is passed, moving easily back and forth. In the end of the bar a cup is dug out, and the inside coated with lard. The bar is made fast to the line, and a sling holds the shot on. When the bar, which extends below the ball, touches the earth, the sling unhooks and the shot slide off. The lard in the end of the bar holds some of the sand, or whatever may be on the bottom, and a drop shuts over the cup to keep the water from washing the sand out. When the ground is reached, a shock is felt as if an electric current had passed through the line.—*Electrical Review.*

TREE HOUSES IN NEW GUINEA.

The great island of New Guinea is rather larger than the State of Texas, having an area of about 300,000 square miles. Its southern coast is within 150 miles of the northeasterly coast of Australia. This near contiguity to the southern continent has led to the feeling on the part of the Australians that New Guinea ought to be annexed to the British empire, especially as the French had attempted to seize Madagascar and the Germans were gobbling up other islands. The Australians became fearful, if the English did not occupy New Guinea, some of the other nations would do so. Accordingly, on the 30th of Oct., 1885, a military force was landed, the British flag hoisted, and the country duly annexed, the natives of course consenting. Our engraving shows some of the tree houses used by the New Guineans as places of safety and defense during wars or attacks of robbers. Each house holds a party of ten or twelve individuals.



TREE HOUSES IN NEW GUINEA.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court, District of New Jersey.

New York Belting and Packing Company *vs.* Allan Magowan *et al.*

By Nixon, D. J.

Letters Patent No. 86,296, for "Improved vulcanized rubber packing," were granted to the complainant corporation, as assignee of Dennis C. Gately, and this suit is brought to recover profits and damages for their infringement.

The answer of the defendants:

1. Denies infringement;

2. Alleges that Gately was not the original and first inventor of the thing patented; and

3. Claims that the letters patent are void—

(*a.*) Because the single claim is too broad, covering more than Gately invented. (*b.*) Because the specifications fail to distinguish between what was novel and what was old in the art. (*c.*) Because, in view of the state of the art at the date of the issue of the patent, no invention is exhibited and shown.

The defense of non-infringement was not well taken, not being sustained by the evidence. The packings manufactured by the defendant in 1882 and 1884 were exhibited. The first was an exact counterpart of the complainant's product, under its patent, and the second was a feeble attempt at evasion by having only the central part of the inner surface of the canvas next to the piston rod cut bias.

The other defenses, which may be fairly grouped under the single allegation of want of patentability of the invention in view of the state of the art, have caused more difficulty, and required more careful examination.

In the specification of the patent, the inventor states that his invention relates to packing of the kind for which letters patent were issued to Charles McBurney on June 28, 1859; that the defect of the McBurney invention was that the packing was not sufficiently elastic to maintain a tight joint between it and the piston rod, and that he has secured this greater elasticity by "forming the packing with a backing of pure vulcanized rubber, . . . which may be covered and protected by a strip of canvas or other suitable fabric." He claims that when a packing thus formed is placed in the stuffing box and around the piston, and the follower is screwed down so as to compress the packing, the rubber strip will also be compressed, and forced against the sides of the stuffing box; and as it cannot expand in the direction of the follower, it acts as a spring to hold the packing against the piston rod and to prevent leakage, compensating for any slight wear in the packing and making a tight joint between the rod and the packing. The claim of the patent is, "The combination with the packing such as herein specified of an elastic backing or cushion of vulcanized India rubber, substantially as and for the purpose set forth."

It is quite clear from these specifications that the patentee conceived that he had remedied the defects and made an improvement on the then existing McBurney patent. It was claimed by the inventor to be a durable substitute for the hempen packing before employed in stuffing boxes, more easily adjusted to produce a uniform pressure upon all sides of the piston rod, but in practical use it fell short of accomplishing what the patentee claimed for it. Frequent complaints came from the purchasers to the manufacturers that it was too stiff and rigid, and was not compressible enough to make a tight joint in the stuffing box. Gately, the patentee, who was the superintendent of the complainant corporation, set himself to the task of overcoming the defects. He made several experiments, and the result was the patent on which the suit is brought. He added to the McBurney packing the elastic backing or cushion of vulcanized India rubber, which not only rendered the whole more compact and more elastic, but, being compressed between the follower and the sides of the stuffing box, acted as a spring to hold the packing continuously against the piston rod, thus making a tight joint, which had not been attained under the McBurney invention, and was not shown to have been so well accomplished under any other patent.

Whether the thing devised is due to the genius of an inventor or to the mechanical skill of a workman is often a difficult question to determine. The line between them is not always clearly drawn. Invention indicates genius and the production of a new idea. Mechanical skill is applied to an idea and suggests how it may be modified and made more practical; and according to *Smith vs. Nichols*, 21 Wall., 112, such mere modification is not patentable unless some new and useful result is secured.

The complainant's patent is nearly on the line dividing invention from mechanical skill. But after carefully comparing it with the exhibits which are put in to show anticipation and its lack of patentability, I am of the opinion that the patent reveals invention; not so much because the packing is more elastic by reason of the addition of pure hard rubber, but because the patent discloses a new and better method of obtaining a tight joint between the packing and the piston rod than has been obtained by any other combination of elements, new or old.

It is a fact not to be overlooked, and has much weight, that the products manufactured under it went at once into such extensive public use as to almost supersede all packing made under other methods. Such a fact is pregnant evidence of its novelty, value, and usefulness, and accounts for the defendant's infringement.

Let a decree be entered in favor of the complainants and for an account.

AN American correspondent of the *Pharm. Centralh.* states that many manufacturers of carbolic acid prevent it from turning pink by adding a small quantity of phosphoric acid.

ENGINEERING INVENTIONS.

A car coupling has been patented by Charles M. Ingersoll, of Summit Hill, Pa. This device consists of a novel construction and combination of parts, whereby the cars will be coupled automatically when run together, and can be readily uncoupled, while it is simple in construction, strong, and not liable to get out of order.

A railway switch has been patented by Mr. John T. Rider, of South Oil City, Pa. It is so made that the front wheel of an approaching train presses down the inner end of a dog, which withdraws a latch, when by another dog the switch is automatically thrown, while it will remain locked for switching or shunting trains moving about the switch.

A steam boiler has been patented by Mr. Micheal E. Herbert, of St. Joseph, Mo. It has base sections, each with vertical side and end chambers, a horizontal crown sheet chamber communicating with the side chamber at a point below its upper end, with various other novel means of forming the water space into a number of chambers.

A feed water regulator has been patented by Mr. Leonard P. Foss, of Kalamazoo, Mich. It consists of a valve inserted in the boiler feed pipe and operated by a float working in a chamber connected with the boiler above and below the water line, and is calculated to always maintain a uniform water level in the boiler.

A boiler furnace has been patented by Messrs. John, Joseph, and Francis Zerr, of Keokuk, Ia. It has two fireboxes, and a novel arrangement of parts, whereby, when in operation, the products of combustion of one firebox, after having given out their principal heat to one boiler, will be made to pass through the other firebox, whereby all the smoke, gases, and other consumed particles will be fully burned and thoroughly utilized.

A condenser has been patented by Mr. Augustus Fletcher, of Hazleton, Pa. It consists of a section of pipe formed with a globe-shaped enlargement or chamber into which the exhaust steam is led, through which is passed a central imperforate cylindrical tube, with induction and eduction ports, there being flowing cold water in the chamber to condense and carry off the steam, so that with this device there will be no jarring in the working of a pump.

AGRICULTURAL INVENTIONS.

A cultivator tooth has been patented by Mr. Leander Burk, of White Cloud, Mich. (Charles Burk, of Wilcox, Mich., administrator of said Leander Burk, deceased). It is formed with two prongs at its lower end, and a mouldboard adapted to either prong, with special devices for supporting the mouldboard on the tooth and allowing its adjustment to either of the prongs.

A thrashing machine has been patented by Mr. Horace A. Wetsell, of Tracy, Minn. It has two thrashing cylinders to act in succession on the grain, and the concave and grids will yield if any heavy obstacles get into the machine, so as not to bend the teeth, choking off the grain is avoided, and the operator is not exposed to dust and sticks thrown by the cylinder.

A combined seed planter and fertilizer distributer has been patented by Mr. John I. Boswell, of near Chase City, Va. This invention covers various novel features and combinations of parts in a machine constructed to drop the seed at uniform distances apart, and which may be arranged to drop the fertilizer either with the seed or before and after it, or in continuous drill.

MISCELLANEOUS INVENTIONS.

A churn has been patented by Mr. Almer Farley, of Coomer, N. Y. It has a supporting swing frame and attachments of the churn body, so that it can be worked by an endwise rocking motion with but little fatigue to the operator, and it can be packed in a small space when out of use or for transportation.

A combined pole and shafts for vehicles has been patented by Mr. Aaron J. Martin, of Evansville, Ind. By this invention one construction is made to answer the purpose of a pole or shafts, making a simple, improved draught attachment, easily adjustable for use with one or two horses.

A horse tail holder has been patented by Mr. Frank H. Turnure, of Graham, Mo. It consists of a frame having a movable cross bar, and with a strap and buckle, the same being adapted to receive the bushy end of a horse's tail and hold it in a compact but easily released knot.

A washing machine has been patented by Mr. John Barr, of St. Louis, Mo. It is a revolvable wash boiler made to rest on a stove, with trunnions supported by a hoisting apparatus, so that the boiler may be readily raised and revolved, and thus cleanse the clothes.

An egg register has been patented by Mr. Casper Marti, of Minneapolis, Minn. A suitable box has a pivoted platform, with apertures at one end for receiving eggs, a counting device being operated from the platform, whereby the eggs will be automatically counted and the number registered.

A bung lifter has been patented by Mr. William Nahrung, of Brooklyn, N. Y. It has a screw to screw into the bung until the legs of a stand carrying it shall rest upon the staves, when the bung can be lifted vertically from its seat by a simple cam lever arrangement.

A journal box has been patented by Mr. Charles L. Morehouse, of Brooklyn, N. Y. It has tubular rollers, sleeves, collars, and rings, so arranged as to secure a perfect circulation of the lubricant, while the lateral jolts of the wheels will not be transmitted to the car body, and friction will be reduced to a minimum.

A summer house and bath house has been patented by Mr. Francis I. Palmer, of New York city. It is composed of a suitable frame, prepared in sections to be portable, to be readily set up and taken down, with a detachable roof, and having curtained sides, to be raised to form an open summer house, and lowered to convert it into a bath house.

A tobacco pipe stem has been patented by Mr. William B. Kennedy, of Silver Reef, Utah Ter. It has transverse grooves at intervals through the body, in connection with other grooves and openings and plates for covering them, in order to form a pipe which will cool the smoke and which can be cleaned very easily.

A broom has been patented by Mr. Richard D. Gallagher, of Plattsmouth, Neb. The stick is slotted at its lower end, with a shoulder against which rests a collar, and an elongated cup against the collar, with other features for stiffening the upper part and making the lower part more elastic or springy, and so the broom will be firmly held in its handle.

A handkerchief box has been patented by Mr. Louis P. Shuler-Shutz, of New York city. The box has a removable frame with tapes or ribbons secured to it to hold the handkerchiefs in place, and permit them to be removed without disturbing the tapes or ribbons, while they are held as nicely in the box as though tied in bunches.

A punching machine has been patented by Mr. Willis Whited, of Lachine, Quebec, Canada. Combined with its sliding head and the operating mechanism are certain devices which can be used to stop the movement of the head at a certain point, which is variable by adjustment, so that the punch may be brought to rest in any desired position.

A bag or satchel catch has been patented by Messrs. Louis B. Prahar and Charles S. Shepard, of Brooklyn, N. Y. The frame has a stem attached, on which is mounted a hollow rotary thumb piece, a spiral connecting the stem and thumb piece, while there is a spring latch attached to the other part of the frame, to engage with the stem and thumb piece.

A musical top has been patented by Mr. Robert Richardson, of Detroit, Mich. It has a toothed cylinder arranged to operate a comb, a fan supported partly or entirely within the shell of the top, with a worm wheel on the periphery of the toothed cylinder, so the comb will be operated by the rotary motion of the top.

A carriage top has been patented by Mr. Rasselas E. Earl, of Dunkirk, N. Y. This invention relates to carriage tops constructed with the bow arm eyes made of bars bent to form the eyes, and having arms of equal or unequal length, the object being to increase their strength and durability and promote convenience in their use.

A fire escape has been patented by Mr. Joseph H. Clifton, of Weston, W. Va. The device covers a main supporting plate that can be conveniently secured to the framing of a house, in connection with a swinging arm and pulley, making a fire escape which may be adjusted entirely out of sight from the street when not in use.

A press has been patented by Mr. Julius H. Holmgreen, of San Antonio, Texas. It is to facilitate the baling of cotton and other fibrous substances, and consists of compressing rollers in suitable bearings to coincide with an inlet channel to guide the substances into the baling box of a press after the rollers have effected a preparatory pressing.

An automatic water service system for windmills has been patented by Mr. Calvin G. Frushour, of La Gro, Ind. It is designed so that the windmill will start to operate a pump as the water is drawn off from a tank connected therewith, and will stop when the tank is refilled, and will operate similarly in connection with any number of connected tanks.

A wood-type case has been patented by Mr. James O. Stewart, of Spirit Lake, Iowa. It is composed of a series of rack frames or leaves hinged to open or close like a book, partitioned by narrow shelves made removable, with guards in front to hold the type, so that the latter may be kept free from dust and at the same time readily accessible.

A lifting jack has been patented by Mr. Henry Walther, of Clinton, Ind. Combined with a toothed rack mounted in a standard is a pinion, and crank arm secured to the shaft of the pinion, the shaft carrying a ratchet to engage with a pawl, and the rack carrying two arms, so that a wagon axle can thereby be readily raised, held, and again lowered to the ground.

A folding camp stool has been patented by Mr. Charles von der Linden, of Rhinebeck, N. Y. It is made with two socket pieces and legs to be held therein, pieces for holding the legs in the socket pieces, and a screw and nut for holding the socket pieces and pressing pieces together, making a stool which can be compactly folded and quickly put together.

A chicken house has been patented by Mr. Richard Bentley, of Corning, Iowa. This invention covers a novel construction, which may be large enough to shelter a dozen broods, and so light that two persons can pick it up and carry it, giving the chickens plenty of air and light in the daytime, and affording protection at night.

A pipe wrench has been patented by Messrs. Christian Bonnichsen and Michael R. Chrystal, of Newburg, N. Y. The wrench handle has lugs on its butt end, a bifurcated swinging connection, and jaws, in connection with a gripping chain, and other novel features, making a very efficient wrench, readily adaptable for different sizes of pipe.

A wear plate for harness has been patented by Mr. La Fayette Hartson, of Wyoming, Iowa. It is made with the usual keepers, a drawhook at one end and a hook at the opposite end to receive an independent detachable buckle, with a draw stud projecting from the face of the plate adjacent to the end of the buckle hook, to receive a detachable strap.

A door spring has been patented by Mr. Daniel W. Frost, of St. Louis, Mo. It is a device which can be made fast to the door a greater or less distance from the top edge, a spring being compressed by opening the door, which afterward operates to close it, while the whole construction is simple, effective, and capable of easy adjustment.

A harness has been patented by Mr. John H. Whitaker, of Davenport, Iowa. It is designed to improve the trotting of a horse by causing the hind legs to be spread apart, two lines being connected to and combined with a brace, adapted to be secured under the belly of the horse, the ends of the lines being secured to the ends of the shaft and the body of the vehicle, and passing between the horse's hind legs.

A churn has been patented by Messrs. James E. Shaw and James T. Simpson, of Holden, Mo. It has two concentric frames to revolve the dashers in opposite directions, to alternately elevate and depress the cream, with an inner dasher to throw the cream to the blades of the outer dasher, or which, when reversed, will throw the cream or gather the butter in the center of the churn.

A clothes washer has been patented by Mr. Henry Wright, of Sigourney, Iowa. It has a funnel-shaped plunger, with tubes and valves so arranged that on the downstroke of the plunger the air within the funnel is forcibly expelled through the water, forcing the water and suds through the clothes in a current toward the bottom, thus dislodging the dirt and cleansing the clothes.

A seal lock has been patented by Mr. George B. Williams, of Las Vegas, New Mexico. It is keyless, and in the casing is journaled a rotary hook adapted to be rotated through a complete revolution, with means for locking it, and other novel features, so that the lock cannot be opened without destroying the seal, and is especially adapted for car doors and similar uses.

A riving machine has been patented by Mr. George E. Cooke, of Clarksville, Tenn. This invention covers various novel features in the construction and combination of parts of a machine adapted more particularly for riving bolts or blocks of timber in the manufacture of shingles, to enable the machine to perform good work continually with economy of time and labor.

An adjustable holder for scarfs for neckwear has been patented by Mr. William B. Pope, of New York city. This invention consists in a holder with a bar fitted for attachment to a collar button, and held in the face of the holder, together with a cam or equivalent device for holding the plate and bar adjustably together, the holder being secured to the back of the scarf.

A gate has been patented by Messrs. Josiah Austin and Rossco Chamberlain, of East Liberty, O. A cranked rod passes loosely through the gate bearings, having springs, and pivotally connected to the gate post, the cranked rod having a recessed plate rigidly secured to one end, with mechanism for operating the same from opposite sides, and so that the gate may be opened or closed by persons at some distance away.

A method of making button holes in leather gloves has been patented by Mr. Joseph Whitby, of Yeovil, Somerset County, England. By this invention the edges of button holes are bound with silk, linen, or other suitable material, the stitches penetrating the material of the glove as well as the binding, in as many rings as desired, the stitching being conveniently made by a sewing machine.

A polishing machine has been patented by Mr. Joseph H. Cutler, of West Medway, Mass. It has a swinging frame, polishing head, and rotating shaft, combined with a rack plate, pinion, pawls, and other special features, to form a machine for finishing, dressing, and polishing the surfaces of granite or other stone, and one which can be quickly adjusted for flat surfaces and angles or corners.

A refrigerator for oysters has been patented by Mr. Alexius T. Lundqvist, of Brooklyn, N. Y. It consists of a wire netting casing placed on a base having a groove, and an interior wire netting frame resting on the floor formed on the base, the floor having a funnel and tube for conducting the water therefrom, so that the contents of the refrigerator will be kept cool and fresh and the drip water will be carried off.

A machine for scraping rattan has been patented by Mr. James M. Devany, of Hoboken, N. J. Combined with a table having feed rollers and a frame with radially movable knife holders is a sliding bar operated from one of the feed rollers, the bar having a cam piece and a rocking lever for moving the knife holders, on which lever the cam piece acts, for scraping rattan at the offsets or rings.

A watch regulator has been patented by Mr. George I. Tuttle, of Aurora, Ill. It has an adjustable and detachable connection of the dial, pointer, and pinion, with the regulator arm, admitting of the invention being applied to an ordinary push regulator, and saving the expense of making a special regulator arm, the invention being an improvement on a former patented invention of the same inventor.

A lemon holder and squeezer has been patented by Mr. Edward G. Day, of Riverside, Conn. The jaws or cup portion of the squeezer are compo. of two series of rings, which intermesh with each other to form when closed a chamber or cup to receive the lemon, the construction being such that the squeezer with a part of a lemon may be placed on a table without soiling the table linen.

A permutation lock has been patented by Mr. William B. Turman, of Waldron, Ark. This invention covers novel details in a lock, by which the door can be readily locked from the outside, but cannot be again unlocked without a knowledge of the combination at which the lock had been set, while it can be easily locked or unlocked from the inside without the combination.

A weighing scale has been patented by Mr. George W. Craig, of Grimm's Landing, W. Va. The platform box has a flexible top and bottom, with a single lever, and bearing upon which is a frame that rests upon the lever, and prevented from tilting or moving sidewise by the flexible top and bottom, but allowed to move up and down with the lever by the flexibility of the top and bottom sections.

A controlling mechanism for power driven machinery has been patented by Mr. James H. Rohme, of Newburg, N. Y. Its construction is such that by bearing down upon a treadle with one foot a driving pulley will be moved into and held in contact with a drive wheel, the pulley being revolved with a speed in proportion with the contact pressure, while by bearing upon the treadle with the other foot the driving pulley will be withdrawn from the drive wheel.

A pulverizer has been patented by Mr. William H. Howland, of Englewood, N. J. It is for pulverizing ore and similar substances, and has a disk revolving on a shaft, a ring eccentrically surrounding the disk and resting thereon at the top, with annular side pieces secured to the sides of the surrounding ring and overlapping part of the disk, the machine being so arranged that the coarse material will remain in a pocket, and only that which is fine will be discharged.

NEW BOOKS AND PUBLICATIONS.

BELTS AND PULLEYS. By J. Howard Cromwell. New York: John Wiley & Sons.

There have been several treatises published, giving rules and formulæ for ascertaining the belting required to transmit a given horse power, with different kinds and weight of belting, and varying conditions as to shafting and pulleys, but the ground has never yet been satisfactorily covered. This volume is a valuable contribution to the literature of the subject, and should be carefully studied by the mill engineer or master mechanic who has charge of this part of the business of fitting up or carrying on the work of a large manufacturing establishment. The smaller shops will probably go on, as they have done for so long a time, with a sort of rule-of-thumb calculation, contenting themselves with the reflection that to provide rather too large or heavy belts for their regular work, while costing a little more at first, adds correspondingly to the life of the belt and gives greater immunity from accident or break-downs.

THE COST OF MANUFACTURES AND THE ADMINISTRATION OF WORKSHOPS. By Captain Henry Metcalfe, U. S. A. New York: John Wiley & Sons.

The author who would write all that might be profitably said under the above title would need to fill a library rather than a single volume with his subject. Captain Metcalfe has had an extended experience in the Ordnance Department of the army, in the management of work at the arsenals, and in the examination of the wide variety of supplies required in all departments of the service, and it is safe to say that there are few men in the employ of any government in the world who have so systematically traced up, in a practical way, the questions of quality and absolute first cost covering so many and such different kinds of articles. The details of the present system in the government workshops are here given with great minutiæ, but the author proposes material changes therein that would constitute a really new system, also adapted for a model in the conduct of business in private workshops. The book has numerous examples of special kinds of bookkeeping, in connection with an elaborate system of cards for keeping track of every detail of a large and complicated business, such as many of our representative manufacturing establishments have been for years working out for themselves in their special lines of business.

STATICS AND DYNAMICS FOR ENGINEERING STUDENTS. By Irving P. Church, C.E. New York: John Wiley & Sons.

This volume is in the form of a compact text-book, with examples for exercise in the rules given, and, being by a Cornell professor, probably outlines a portion of the class work in the mathematics of civil engineering, to which the book is exclusively devoted.

INORGANIC CHEMISTRY. By Professor Victor von Richter. Translated by Edgar F. Smith. Philadelphia: P. Blakiston, Son & Co.

This is the second American, from the fourth German, edition of a text-book on chemistry which has long been deservedly popular. It is markedly practical, clear, and direct in its statements, bringing out prominently the relations between proved facts and theories or hypotheses, so as to preclude as far as possible speculative inferences from the mind of a student beginning the study of chemistry. In the present volume, many parts of the original work have been rewritten, and much new matter added, as called for by the recent progress in chemical science.

INDICATOR PRACTICE AND STEAM ENGINE ECONOMY. By Frank F. Hemenway. New York: John Wiley & Sons.

The author has, in this book, endeavored to present his subject so comprehensively that any engineer will be able to apply the indicator, take the diagrams, and make all necessary calculations, while the terms used are such as can be readily understood by any mechanic, and no mathematical demonstrations are required that involve the use of anything but simple arithmetical calculations.

U. S. DIRECTORY OF THE MUSIC TRADE AND MUSICAL PROFESSION. New

This cannot fail to be a very useful work to all who make their living as musicians, or who are specially interested in that line, as well as the various departments of the music trade. It has the names of 4,000 musicians of the better class in the United States, and 6,000 names of firms engaged in the music trade.

Received.

THE NEXT WORLD INTERVIEWED. By Mrs. S. G. Horn. New York: Thomas R. Knox & Co.

MECHANICS AND FAITH: A STUDY OF SPIRITUAL TRUTH IN NATURE. By Charles Talbot Porter. New York: G. P. Putnam's Sons.

Insurance.

LIFE INSURANCE AS AN INVESTMENT.

The value of a man's life cannot well be expressed in dollars, but the value of his services to those dependent upon him can be estimated, that is to say, through life insurance every family can be positively assured of a sum on the death of a husband and father which will provide them a support such as his services gave during his life.

Life insurance in its simplest form contains only the element of indemnity, that is, a pecuniary provision based upon the contingency of the death of the insured. In the regular and substantial companies, the payments required are so adjusted that they continue equally through life, and are fixed at the age of entry These results are accomplished through the legal reserve which legitimate companies are required to keep—designed specially to cover the increased mortality at advanced ages. Reserves are the important element for securing permanency, which the co-operative or assessment companies do not provide.

During the past twenty years, another and a most attractive and desirable element has been connected with pure life insurance, which popularizes it with the insuring public. The element to which we refer is an investment feature, so largely represented in what are known as endowment policies. These cover the double object of protection to the family and a guarantee to the insured of support in old age. Thousands who were wise in the past are now reaping the results of their forethought and action by the payment to them of the amount of their matured endowment policies. Millions of dollars are annually paid to the holders of such contracts, the benefits of which are far reaching and inestimable.

Endowment policies are so made that no loss can be sustained by reason of a failure to pay the premiums, for the insured are guaranteed an equitable value in paid-up insurance in such an event. They are non-taxable, and, if properly made, are payable directly to the beneficiaries beyond the intervention of creditors.

Statistics show that only about two per cent of those who engage in business are continuously successful through life. Of every hundred business men, about ninety-eight do not succeed, and many of them die leaving their families to the tender mercies of "cold charity." The importance, therefore, of such a provision as life or endowment insurance affords is too apparent to require comment. It is the only means by which a family can be positively secured and, at the same time, the insured himself be guaranteed a support in advanced age. It stimulates thrift, encourages economy, and secures for the money paid greater satisfaction than any other form of investment.

In order to obtain the best results in life or endowment insurance, a company should be selected of established reputation for strength, economy, and fair dealing. The organization that conducts its business at the least expense, and receives upon its investments the largest rate of interest, can, for a series of years, give to its insurers the largest returns in reduction of premiums; that is to say, the cost of insurance in a company standing at the head in these important respects will be less than in a company of greater expenses and one having less remunerative investments.

Of the reports of the companies whose annu. statements are before the public, our attention has been attracted by that of the Ætna Life, of Hartford, not only as regards its financial strength, but also the peculiar attractiveness of its plans.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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is an expression of Milton regarding the "infernal world." It is not too much to say that those who suffer from catarrh would thus express themselves about that disease. Torture and despair mark their daily existence. However, every case can be cured by Dr. Sage's Catarrh Remedy. Its proprietors have for years made a standing offer in all the newspapers of $500 for an incurable case. It speedily subdues all bad smells, is thoroughly cleansing, antiseptic, soothing, and healing in its effects.

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Curtis Pressure Regulator and Steam Trap. See p. 142.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 46.

Cutting-off Saw and Gaining Machine, and Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

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Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 76.

"Wrinkles in Electric Lighting," by V. Stephen; with illustrations. Price, $1.00. E. & F. N. Spon, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. H. D. of D. C.—You will find an engraving of Kunstadter combined screw and rudder in the SCIENTIFIC AMERICAN of May 18, 1878, and in issue of January 12, same year, an illustration of the process for the manufacture of mineral wool.

(2) W. G. R. writes: 1. Is it a fact that human hair has turned white in a night, or even in two or three days? A. It is generally so accepted, but the instances have been rare, and the proof is not very decided. 2. Is it a fact that octoroons do not have children? A. It is not. 3. What was the negro population of the United States in 1840, 1850, 1860, 1870, and 1880? A. 1840, 2,873,648; 1850, 3,638,808; 1860, 4,441,830; 1870, 4,880,009; 1880, 6,577,497.

(3) J. G. D.—The density of hydrogen compared to air is 0·0693; of ordinary illuminating gas, about 0·6; and of natural gas from Pennsylvania wells, from 0·51 to 0·61. The density of gas taken from the Fuel Gas Company's well, at Murraysville, Pa., which may be considered as a typical producer, is 0·56. Considerable variations exist in the density of the gas from either natural or artificial sources, but the mean results are very nearly alike. There would consequently be very little difference in the ascensional force of a balloon, whether filled with one or the other of the latter gases.

(4) T. S.—Steel untempered is the strongest metal in use for gun barrels, but aluminum bronze is claimed to be much stronger. Your barrel 2 inches diameter ½ inch bore would probably burst at 150,000 pounds pressure. You cannot burst it in a properly proportioned gun. It will sustain a safe working pressure of 50,000 pounds. We have seen a plugged gun of this description filled with powder and fired. The charge went out at the vent, burning it to three times its original diameter. These experiments are extremely dangerous.

(5) H. C. D. asks: What kind of valves are used in air pumps for steam engine condensers? A. India rubber, known in the trade as pure gum.

(6) H. F. S. asks: What should be added to starch to produce a good gloss on linen? A. Pour a pint of boiling water upon two ounces of gum arabic; cover it, and let it stand over night. A teaspoonful of this is added to the starch.

(7) E. H. asks what process Professor Checklie used in catching rats. He is supposed to have used some powerful odor and a dark lantern—the odor to entice them from their holes and stupefy them, and the light to attract them to a certain spot. A. Probably oil of rhodium. Rats and mice have a great liking for the oil.

(8) F. G. V. R. asks: 1. Which is the best brand of Portland cement, that is, which will become the hardest? A. Saylor's American Portland cement is one of the best. 2. What is the best ingredient to mix with Portland cement to get the hardest and finest cast? A. Use 1 part of cement with 3 of sand. 3. Can Portland cement be colored in casting, say black, blue, or red, and if so, what colors to use? A. It can be colored black by the addition of charcoal, blue by adding smalt, and red by adding iron oxide. 4. Can I polish a casting of Portland cement, and how? A. It will not take a polish if pure. See "Portland Cement: Its Manufacture and Uses," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 386.

(9) N. W. N. asks: 1. What is the process of lettering in gold on leather or cloth as done by bookbinders? A. The place where the lettering is to appear is coated twice with albumen, and then covered with gold leaf. The title, locked up in a fillet, is then heated and pressed into the leather. Any superfluous gold leaf can be readily wiped away by using a soft rag. 2. Also the process and what materials used in sprinkling edges of books? A. Take an old toothbrush and dip it into a colored ink; shake off the superfluous ink, that the sparks formed may not be too large, and draw an old comb through it in such manner as to make the ink fly off in sparks over the edges of the book.

(10) E. R. asks how the black finish or enamel is put on sheet iron ware, such as toy shovels, fire shovels, etc. A. Use black japan varnish, put it on with a brush or by dipping; thin the varnish with turpentine to a suitable consistency for your work. Bake the article in an oven heated to 250° Fah. See full process described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310. You can get a copy of the *Official Gazette* from the Patent Office.

(11) J. L. P. sends us the old question about cutting figures out of paper, so that if cut in one way the actual surface will be greater than if cut another way. The figure he sends cut in paper is not correct. The pieces do not fit, as can be plainly seen. There is no problem in this. There is a form of cutting the pieces so that they will fit exactly both ways. Then their surfaces are alike in both forms.

(12) S. B. H. desires instructions for transferring decalcomania, or transfer pictures, on satin, silk, or any material. I find mucilage does not do. A. Use a varnish consisting of equal parts of pale Canada balsam and rectified oil of turpentine. This mixture is sometimes called crystal varnish.

(13) E. J. W. asks: 1. What is the fertilizing value of the shell marl found in tidewater Virginia? A. As a fertilizer, its action is both mechanical and chemical. Being granular, it improves the texture of stiff soils by loosening them, thus rendering them pervious to the air and moisture. It furnishes the inorganic elements of materials for plant food. The most important of these elements are phosphoric acid and potash. 2. How should it be made or applied so as to get the best results? A. It requires no preparation to fit it for use as a top dressing for the soil. It is hauled directly from the pit and spread upon the land.

(14) P. P. B. asks (1) how many pounds 1,000 cubic feet of pure hydrogen gas will lift. A. 70 pounds. 3. What would be the difference in the elevating power of pure hydrogen, say 1,000 cubic feet, and the same bulk of coal gas? A. The latter would lift 38 pounds less. 3. A good size or varnish for balloons? A. India rubber varnish. 4. What materials are used besides silk for the construction of gas balloons? A. Finest cambric and paper.

(15) G. W. D. writes: At what height will it be necessary to place a tank, with a 6 inch main running from it 2,500 feet long, with one elbow in same, to secure force enough to attach three 2 inch hose to same, and with 1¼ inch nozzles, and throw a stream of water 40 feet high? A. Make the bottom of reservoir not less than 90 feet above the hydrants, and of sufficient size to sustain a flow of at least one cubic foot per second during any possible requirement; say 3,600 cubic feet for one hour. You will also do well to attach your pump to the 6 inch pipe near the mill, with an ample air chamber, to prevent water ram. Pump may be driven by steam or water power.

(16) G. B. B. desires a recipe to make non-freezable liquid wash blue. A. The addition of glycerine will probably accomplish your purpose. This substance does not freeze in winter, nor evaporate in summer. A very small proportion of glycerine is used in water meters.

(17) To W. J. M., T. P. P., and many others, who have asked for inks that would be of a specified character, and then fade out after a longer or shorter period, to be regulated as desired, we would say that there are substances which will make a fair ink, and soon fade out on exposure to the air. But to make public the directions for making such an ink would afford to ill disposed persons facilities for easily perpetrating various frauds, and we therefore conceive it to be against public policy to reply to such questions in these columns.

(18) J. P. asks (1) how mineral wool or everlasting wicks are made. A. The wicks used in the perpetual lamps (see "Science in Antiquity," SCIENTIFIC AMERICAN SUPPLEMENT, No. 409) are said to have consisted of asbestos or gold wire, but we are advised by dealers in asbestos that wicks cannot be made from asbestos or mineral wool. Nor do we know of any means of making wicks fireproof. Asbestos was tried for this purpose some three or four years ago, but they soon became non-porous. 2. Are there any chemicals that can be put in coal oil to improve its burning powers? A. No.

(19) Moss desires to know the process generally used for curing, cleaning, and curling the moss usually found hanging from trees in the swamps and marshes throughout the Southern States. A. It is soaked in water to remove the bark, then ginned and sent to market, the curling being natural.

(20) O. & D. ask how to test the candle power of lamps. A. Probably, the most perfect arrangement for testing the intensity of light yet devised, either for lamps, gas, or other purposes, is an electrical method described on page 261 of vol. 52 of the SCIENTIFIC AMERICAN. For further information on other measurements, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 225.

(21) "Dayton" writes: In your instructions on wax engraving (as per issue for January 2), will not the electro plate formed on the engravings, impressions, etc., adhere to the smooth copper plate upon which the thin wax is poured? Will the blacklead with which it is rubbed prevent it? If not, what can be used? A. The blacklead with which both the wax and surface of the copper exposed in the lines are covered will prevent the electro plate from "sticking."

(22) P. G. G. writes: Can you tell me about how many people in the United States are afflicted with cancer, and whether the disease is on the increase or not? Is there any known way of removing cancer without the aid of knives? A. We think there are no means of ascertaining the number of cases of cancer. Even the number of deaths from it cannot be accurately traced, since in the reports they are associated with other forms of tumors. There is no reason to suppose that the disease is relatively on the increase. By "removing cancer" we suppose you mean drawing them out, as is constantly advertised by "cancer doctors." Such claims are impostures and nothing else.

(23) J. B.—We think your proposed plan of freeing sidewalks from snow and ice by running steam pipes thereunder to melt such accumulations would ordinarily cost far more than other methods of removal.

(24) S. W. F. asks what a diabetic should eat. Everything containing starch and sugar has long since been prohibited. Meats and eggs contain both albumen and carbon, and milk to some extent. Will you please state just what food is meant by "albuminoid and hydrocarbonized food"? A. There must be a mistake somewhere. All our animal foods, with the single exception of the "fats," are included in the class of "albuminoids." The fats, both animal and vegetable, are hydrocarbons, while all the starch and sugar foods are carbohydrates, and the term "hydrocarbonized food" must naturally include both these latter forms. Such abstinence as is prescribed in the article quoted would certainly end the diabetes, for it would end the patient.

(25) J. D. G. asks: 1. Could I get a flowing well in about the center of the State of Kansas? A. It is extremely improbable that you will obtain a flowing well in central Kansas, except on low grounds. 2. How can I bore through or manage the quicksand which we find at a depth of 20 feet? A. You may put a drive well through the quicksand. 3. What pressure of air is indicated by column of mercury in glass tube of gas filter pipe proving gauge? A. If the mercury gauge is a siphon, each inch rise indicates a pound pressure nearly. If the gauge rises from a cistern, it requires nearly 2 inches rise to indicate a pound.

(26) W. B. asks when the Winnecke comet will return, the name of the next comet to return, and if Biela's comet or part of it will ever return, and when. A. The Winnecke comet was last seen in 1875. It has a five and half year orbit. Its second return should occur the coming spring. It is supposed that Biela's comet was dissipated in a meteoric shower occurring in November, 1872. Last seen as a comet in 1852.

(27) W. S. writes: A brass spring, after being heated, loses its power. How or by what process is the lost power restored to the spring? A. The hardness of brass is due solely to the compacting of the mass by compression, as in rolling or hammering. In heating brass, the original and natural condition is restored, and only a repetition of the process of rolling or hammering will again harden it.

(28) A. B. W. asks the best material to use to prevent water from freezing in iron pipes above ground. A. Cover the pipes with hair or plaster felt, or make a box around the pipes and fill it with sawdust, shavings, or wool.

(29) T. H. K. writes: I am going to make a half dozen No. 14 plate iron barrels about 25 inches diameter and 28 inches high, made out of Philadelphia R. G. iron. These barrels are required to be tinned inside with pure tin, the same as tinning sheet copper. How shall I proceed? A. The sheet iron should be thoroughly cleaned from scale, in a bath of 1 part hydrochloric acid, 4 parts of water. The side to be tinned well scrubbed with sand, then laid on an inclined bench and brushed over with muriate of zinc and sal ammoniac (tinner's acid); pour the melted tin over the surface, allowing it to run down and back into the melting pot, the process being a repetition of that used in tinning sheet copper. When the barrels are made up, the joints can be tinned with a soldering copper.

(30) W. G. writes: In a steam cylinder where the piston rings are steam packed, does the steam enter the follower on both ends of the cylinder or on only one? A. There is a small leakage into the piston at both ends, depending entirely upon the closeness of fit of the rings. It should be no more at one end than the other, provided the bolts that hold the follower make a perfect joint under their heads.

(31) W. H. S.—A steam pleasure boat of less than 5 tons register needs no license. Over 5 tons, the license fee is $5.00 to a United States inspector. Your 3 horse power engine will do for about 6 to 7 miles an hour. All boats have to pay lockage where such regulations are in force.

(32) W. T. W. A.—The hay stack could take fire by spontaneous combustion from the heat generated by fermentation. We cannot recommend anything for ingrowing nails, except more constant care.

(33) D. B. G. asks: 1. Of what advantage is a slack between the cars in starting a heavy loaded freight train? Does it aid the engine in starting? A. The slack connections between freight cars aid the engine in starting a heavy and long train by giving motion to the cars successively. 2. Is it simply because of annoyance to passengers that it is not used on passenger trains? A. Slack connection exists on passenger trains to some extent, but controlled by a spring in the coupler and a spring buffer, which lessens the shock. Cost of construction is the probable reason that spring buffers and couplings are not used on freight cars.

(34) H. D. J. desires a pure fruit acid as substitute for tartaric acid, at about one-third the cost, to use in the manufacture of jellies. A. There is an acid sulphite of lime, better known as the bisulphite of lime, which is used for the purpose mentioned. An excellent quality of this compound is known as Horsford's sulphite.

(35) J. M. asks: What chemical ingredient can I mix with water to prevent it from freezing? A. Glycerine is used to prevent water freezing in gas meters.

(36) Q. T. S. asks: 1. What preparations are more commonly used in waterproofing paper and pasteboard? A. See articles on this subject in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 39, 96, and 267. 2. What is the chemical composition of the so-called "liquid glass," and about how expensive is it in large quantities? A. It is either a silicate of potassium or sodium. See "Water Glass," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 307. The liquid is worth 5 cents per pound.

(37) E. R. R. asks how to mark or ornament polished steel, such as we see on saw plates, etc. A. Take 4 parts by measure of pyroligneous acid, alcohol 1 part. Mix, and add 1 part nitric acid (sp. grav. 1·28). This constitutes the etching fluid. The steel is coated with wax and the design made by means of a needle, and then the liquid is used to eat the metal away.

(38) C. F. B. asks how to make a liquid extract of beef that will keep six months or longer. A. Cut the lean of fresh killed meat very small, put it into eight times its weight of cold water, and heat it gradually to the boiling point. When it has boiled for a few minutes, strain it through a cloth and evaporate the liquor gently by water bath to a soft mass. Two pounds meat yield 1 ounce extract. Fat must be carefully excluded, or it will not keep.

(39) J. M. asks (1) for a recipe for a cheap solution, to make Manila or Sisal fiber fireproof, at the same time preserving it without staining. A. The following mixture, consisting of boric acid 6 pounds, ammonium chloride 15 pounds, pure borax 3 pounds, and water 100 pounds, is applied by immersing the articles therein. 2. Proportion of alum and soap to gallon of water for a good size that will not peel. A. Spon says simply, "Apply a solution of soap to the wrong side of the cloth; when dry, go over again with a solution of alum." Under such circumstances, use only sufficient water to dissolve the alum.

(40) J. W. Q. asks the carrying capacity in pounds of a scow 42 feet long and 11½ feet beam. A. 2424 pounds to 1 inch in depth, if the above dimensions are on the water line. As the scow settles in loading, the capacity will slightly increase per inch. Say about 15 tons for an additional draught of 1 foot.

(41) H. B. S. writes: Having a boiler with twelve square feet fire surface, a 1½x3 inch engine, with oscillating cylinder, and a boat 12 feet long by 2 feet 6 inches beam, what size and pitch of propeller is required, and what speed can be realized in still water? Boiler, engine, and boat weigh 175 pounds. A. Propeller 12 inches diameter, 30 inches pitch, will give you a speed of 4 to 5 miles per hour, with 60 pounds steam pressure.

(42) O. P. F.—A "water bath" is used instead of a "sand bath" for heating glass alembics or other glass vessels used for distilling or evaporating. It may consist of any vessel of hot water in which another vessel may be placed for heating. There is little saved by oiling or even painting a floor that wears fast by use. Floors of dwellings or rooms that are kept clean and not much used may have their appearance improved by oiling with boiled linseed oil or painting.

(43) W. F.—The motions of barometer and thermometer are mostly in opposite directions during storm periods, occasionally otherwise—the direction of the storm winds varying their relations to considerable extent. The fair weather ranges of both instruments are very tantalizing, unless considered in connection with the direction of the wind, cloudiness, and humidity. A series of simultaneous meteorological curved lines made to a scale (in our possession) shows the most fantastic relations imaginable. The steel indices in a registering thermometer are held by capillary attraction of wetted surfaces when drawn down the scale by the alcohol; they are pushed up the scale before the mercury by resistance to capillary contact, the index being held to the glass by the adhesion of contact.—Objects do not lose their power of gravitation in a vacuum.

(44) C. S.—Bessemer steel is made in the United States equal to that made in England.

(45) M. E. E. asks a way in which lead can be made tougher and more durable, without becoming harder, or much harder. A. Alloy with tin. 2. A cheap substitute for India rubber. A. We know of nothing cheaper that is as durable and retains the main qualities.

(46) O. S.—The value of mica, according to its size and quality, is from 25 cents to $5.00 per pound. The average price during 1885 was $2.50 per pound. To be marketable, the mica must be clear and transparent and sufficiently large to be used for stoves, etc. Its fire-resisting properties are usually tested.

(47) G. W. K. writes: Using one pound coal for evaporating seven pounds water or fluid, feeding the boilers at 200 degrees, how many pounds of coal will be required to evaporate 700,000 pounds of water or a fluid evaporating at 220 degrees? This question refers to evaporation of brine, which boils at about 220 degrees. A. At the rate named, it will require about 107,000 pounds to evaporate 700,000 pounds of water as salt brine. One pound of coal to evaporate 7 pounds of water is not in accordance with modern practice; 1 pound to 10 or 11 is an ordinary result, and with any kind of regenerating system, 1 pound of coal to 13 or 14 pounds water, or 1 pound of coal to 10 lb. of brine, is possible and feasible.

(48) C. R. R.—For your safety valve: Divide the weight of the ball in pounds by the area of the safety valve, which quotient will be the pressure per square inch in pounds, if the ball were set upon the pin of the valve. Divide the required pressure per square inch by the distance of the center of the pin from the fulcrum in inches. This quotient, multiplied by the first quotient, will give the length from fulcrum to center of ball, in inches. You do not give enough particulars to calculate exact horse power; about 500 probably.

(49) B. C. writes: I have a meerschaum pipe broken at the elbow. What kind of cement shall I use to fasten it together? A. Use quicklime mixed to a thick cream with the white of an egg.

(50) C. E. W. asks: 1. An explanation and diagrams of construction of the polyopticon for throwing enlarged pictures on white screen from solid objects or prints, as the magic lanterns do from transparent slides? A. The polyopticon is in every particular like a magic lantern with the condensing lens left out and the light placed in front of the picture on one side of the optical cone, and shaded, so that the direct light shall not pass through the lenses. You may inspect them at the optical stores in your city. 2. A rule or formula for draughting from any given diameter of spheres a covering to be in two pieces, shaped something like the figure eight, such as is used generally for covering base balls? A. Make the diameters of each circular half of cover equal to half the circumference of the ball plus the thickness of the cover. If elastic, allow for its stretching. McKenzie's "weather cycle" was a theory that has not been verified.

(51) A. G. L. desires (1) a receipt for baking powder. A. Take of:

Powdered cream tartar	30 ounces.
Sodium bicarbonate	15 "
Flour	5 "

All well dried; mix thoroughly, and keep dry. 2. Egg powder (such as is used to make pancakes, etc., without eggs). A. By the addition of about ½ drachm turmeric powder to each pound of baking powder, it is converted into egg powder. 3. Linen gloss (I mean the powder gloss, something that can be used in cold starch (raw starch) for giving a fine gloss to shirt collars, cuffs, etc.). A. White wax 1 ounce, spermaceti 2 ounces; melt them together at a gentle heat. When you have prepared a sufficient amount of starch in the usual way, for a dozen pieces, put into it a piece of the polish about the size of a large pea. 4. Dry soap, or what is sometimes called extract of soap. A. We presume you refer to the essence of soap, which consists of 4 ounces Castile soap in shavings, 1 pint proof spirit; dissolve, and add a little perfume.

(52) C. M. W. asks: Will common black powder explode in a vacuum? A. Frick says, "Gunpowder burns without explosion in a vacuum," and also powder may be set on fire by means of a lens within an exhausted receiver; but it will be found to burn away slowly without explosion." These statements are substantiated by experimental data given in the memoir on the "Explosiveness of Niter," by Robert Hare, and published by the Smithsonian Institution in 1849.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

F. F.—Of the specimens sent, No. 1 appears to be a piece of slaty rock; No. 2, a weathered slate; No. 3, a shale; No. 4, a slate; and No. 5, limestone. There is nothing in their appearance to determine their geological age, nor do they at all indicate the presence of coal. As to further prospecting, we are unable to advise.—J. W. B.—The earth is without value in New York. It lacks body, and is too gritty to be useful as a pigment. If carefully sorted, ground, and mixed with oil, a local mineral paint might be made from it.—A. W. C.—The specimen sent has no economic value.

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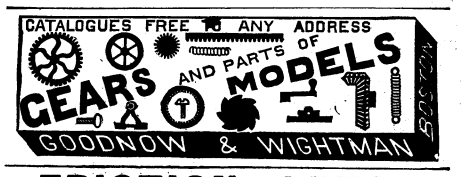

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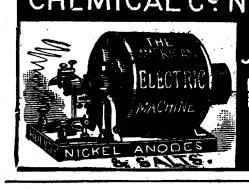

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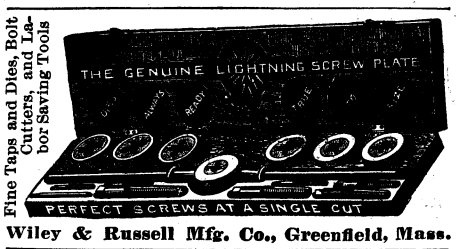

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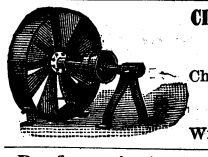
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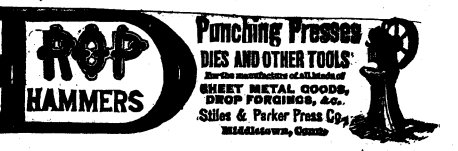

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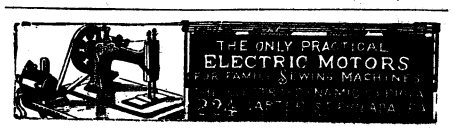

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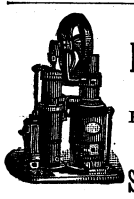

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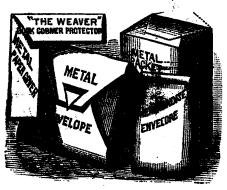

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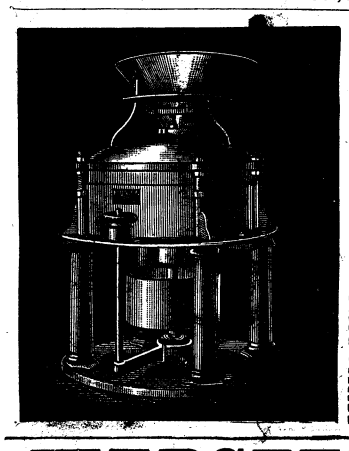

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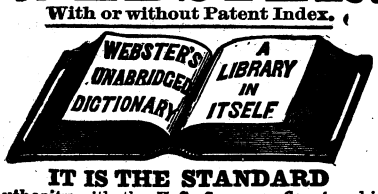

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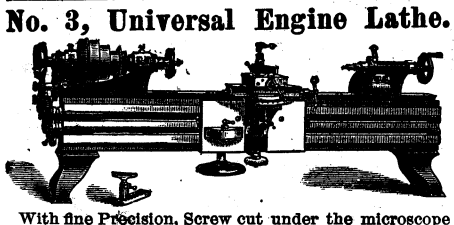

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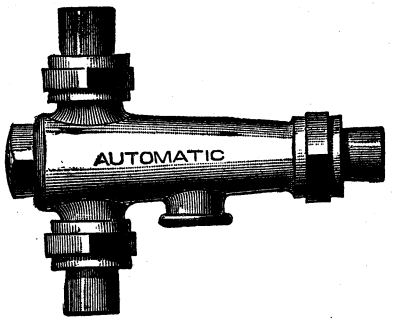

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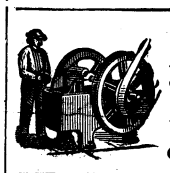

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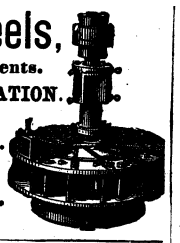

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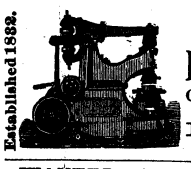

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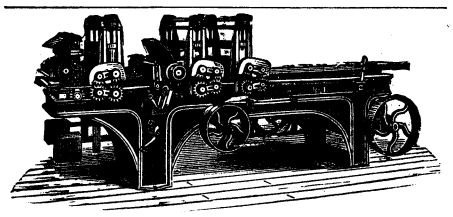

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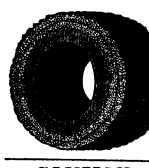

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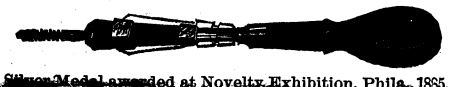

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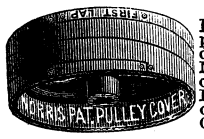

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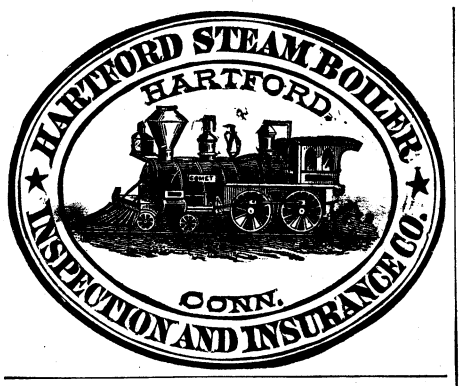

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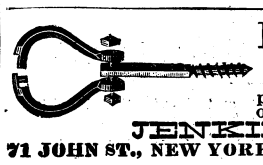

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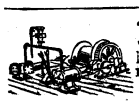

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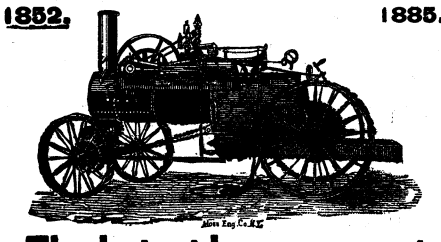

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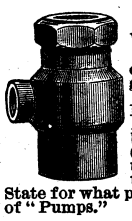

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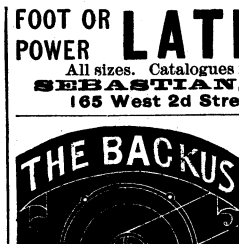

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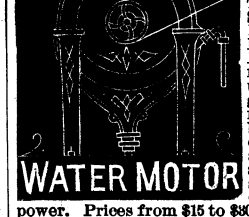

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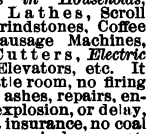

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